USE OF HYBRID VENTILATION TECHNIQUES FOR IMPROVED ENERGY EFFICIENCY OF FAN SYSTEMS

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USE OF HYBRID VENTILATION TECHNIQUES FOR IMPROVED ENERGY EFFICIENCY OF FAN SYSTEMS

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SUMMARY

The goal of this thesis was to improve the energy efficiency of building ventilation systems by exploring new methods of applying natural ventilation concepts. Strictly natural systems have limitations in which climates they can function or can provide optimal performance; these limitations lead to the use of Hybrid Ventilation arrangements. In general, the term Hybrid Ventilation refers to an application that combines both mechanical and natural ventilation systems in a single building, so that the mechanical components may provide the necessary airflow when the variability of the natural system prevents it from meeting performance requirements.

The most common arrangement is to have two, independent airflow systems, one natural and one mechanical. The natural system provides ventilation so long as conditions allow it to have adequate performance. When the control system determines that the natural airflow is not adequate, the associated openings (windows, vents, etc.) are closed and the conventional mechanical system is engaged.

This study looked at methods of combining the operation of the two systems, such that the natural components improve the efficiency of the mechanical system, and thus the overall energy requirement is reduced.

Two general arrangements were studied using a nodal computer model created by CONTAM-W, a program developed by The National Institute of Standards and Technology (NIST). The first arrangement intended to show improved efficiency of a mechanical system through reduction of airflow resistance (differential pressure) by having a natural airflow design in series with the fan. The second approach was for natural and mechanical airflows to operate in dual, parallel paths so that the airflow magnitude of the mechanical component would be reduced.

In the configuration studied, the series method was not supported by the results. The pressure differentials obtained by the natural airflow were too small to have any measurable impact on the fan energy consumption. Additionally, a closer review of the calculation procedure in the CONTAM program created doubts as to its applicability to this use.

In the second approach a different calculation procedure within CONTAM was used, and the results appear to support the dual parallel path method. Under the conditions reviewed, the introduction of mechanical ventilation partially reduces the effectiveness of the natural system, but the net result is positive. A variable capacity fan in combination with a natural ventilation system would meet performance requirements under all weather conditions and have a significant reduction in required energy input, compared to a standard on-off hybrid design.

CHAPTER 1

INTRODUCTION

Energy consumption, both in terms of depletion of resources and the subsequent effects on the environment, is one of the major challenges facing society today. It is estimated by various sources that 35% to 55% of the energy usage in this country results from the construction and operation of buildings. With magnitudes of this scale, even incremental improvements can have a significant benefit; multiple small changes can combine for major savings.

TRANSPORT ENERGY

For many buildings the single largest contributor to energy consumption is the heating, air conditioning, and ventilation (HVAC) system. The configuration of these systems varies widely because of differing requirements presented by the individual building enclosures, occupancy, and local climate. Some basic components and functions, however, are common to most installations. One simplified method of viewing the energy requirements of the systems is to divide them into two components: the primary "plant" that produces a heated or cooled medium, and the "transport" component that delivers this medium from the plant to the location where it is needed. For example, a boiler (the "plant") produces hot water, and a pump (the "transport") delivers the water to heat exchangers in the space to be warmed. Or, a packaged refrigeration unit (plant) chills air, and a fan (transport) blows the air into the space that is to be cooled.

Improving the efficiency of each component is a goal of both equipment manufacturers and system designers. While the plant portion is typically the larger energy user – and high efficiency boilers and water chillers have made major improvements over the past 20 years – the transport component is also significant. Lower energy use variable speed pumping systems have become more common in recent years, and the variable air volume (VAV) fan system is the industry standard for many occupancies.

NATURAL VENTILATION

According to ASHRAE, "natural ventilation is the flow of outdoor air caused by wind and thermal pressures through intentional openings in the building shell. Under some circumstances, it can effectively control both temperature and contaminants in mild climates, but is not considered practical in hot and humid climates". The limitations stem from the variability of the wind (airflow is not consistent) and from the inability to de-humidify with ventilation only.

In the general concept, outside air enters and leaves the building through intentional openings (as opposed to "infiltration" through cracks or other "leaking" points) such as windows, roof ventilators, vertical flues, or other specially designed openings. The ventilation rate provided by the wind varies with such factors as average wind speed, prevailing direction, and local obstructions (trees and other buildings). Thermal pressures are the "stack effect" resulting from varying temperatures and air density.

HYBRID VENTILATION

In this context, hybrid ventilation refers to an application that combines both mechanical and natural ventilation systems in a single building, so that the mechanical components may provide the necessary airflow when the variables discussed above do not permit the natural system to provide adequate performance. The most common arrangement is to have two, independent airflow systems, one natural and one mechanical. The natural system provides ventilation so long as conditions allow it to meet performance requirements. When the control system determines that natural airflow is not adequate, the associated openings (windows, etc) are closed and the mechanical system is engaged.

ALTERNATIVE HYBRID VENTILATION

This study looked at two possible alternatives to the normal "on-off" hybrid set-up in which both systems act together, with the potential to be more energy efficient than switching from one to the other. With both arrangements, when the airflow rate attributable to natural forces drops below minimum requirements, variable capacity fans are engaged to provide only enough air to make up for the shortfall from the natural system.

The first version examined was a series configuration in which a building is designed with a conventional natural ventilation system, but with fans added in series with the airflow path. The input power requirement for any fan system is directly related to the static pressure resistance that the fan must work against. The goal for this evaluation was to see if the natural airflow currents could be harnessed to reduce the resistance to the fan, thus reducing the required power input, which would reduce transport energy consumption.

The second approach was a dual path configuration in which the same natural ventilation design was used but with an outside air fan placed in a separate penetration of the building envelope.

CHAPTER 2

CONTAM-W TEST PROCEDURE

All testing for building airflow was done with a nodal computer model created by CONTAM-W, developed by the National Institute of Standards and Technology (NIST). The assumed building and the baseline model are taken from Georgia Tech's entry to the 2009 IBPSA Student Competition. The building is a three story structure following the competition criteria, and the baseline model uses the pure natural ventilation configuration developed for the Tech team entry.

FAN CONFIGURATIONS-ALTERNATIVE 1

To determine the effect of combining mechanical with natural ventilation, various fan configurations were added to the baseline building; single step simulations were then done and results compared to each other and to the original no-fan setup. Fan configurations were as follows:

A. Single exhaust fan at the top of each of the four stack towers.
B. An in-line fan blowing from the central atrium into the occupied space on each of the three floors.
C. A single supply fan blowing into the grade level intake plenum (below the first floor).

Each configuration was simulated with five different fixed fan airflows, arranged so that the total fan airflow for the building was equal for each set of simulations. All three arrangements were simulated with the original natural ventilation openings, thus allowing parallel airflow through the fan and non-fan paths. Then additionally, for configuration A the non-fan exhausts, and for configuration C the non-fan inlets, were closed so that the total building airflow was through the fan(s); these additional arrangements were designated A' and C'. These inputs can be summarized as follows:

Configuration	Airflow 1	Airflow 2	Airflow 2	Airflow 4	Airflow 5
A	300	600	900	1200	1500
B	400	800	1200	1600	2000
C	1200	2400	3600	4800	6000

Calculations for this portion were done per the Powerlaw Model; details of this method, taken from the CONTAM documentation, are in the appendix.

FAN CONFIGURATION – ALTERNATIVE 2

For the second approach, three different arrangements were initially considered: natural airflow with filters at the ground level air intakes, natural airflow with filters at the openings between the central atrium and the occupied spaces, and filters at the ground level intakes plus a parallel fan blowing outside air into the ground level plenum. Additionally, the baseline model was modified: instead of annualized weather data, fixed speed and direction winds were used to better compare building attributes at a fixed point.

Wind speeds were modeled at 0, 7.5, 15, 30, and 45 mph. With the third arrangement, fan airflows were modeled at 500, 1000, 1500, and 2000 cfm. These results were then plotted against each other to help establish trends of the effect of forced airflow on the natural airflow.

Calculations for this portion used the Cubic Spline method; a detailed description, taken from the CONTAM documentation, is included in the appendix. For the airflow resistance of the filters, resistance vs. velocity data points for a commercially available filter media were input to the program; the CONTAM program produces a curve fit for these points and uses that information for the calculations.

CHAPTER 3

CONTAM-W PROGRAM OUTPUTS/RESULTS

The two alternative fan configurations were evaluated with two different procedures, thus direct comparisons of results are not valid. The alternative 1 set-up was intended to verify an early theory that pressure differentials caused by natural airflows through a building could reduce fan resistance and improve energy efficiency of the fan. The results of the evaluation do not support this theory. A closer look at the computation methodology and assumptions used by the program calls into question whether they were appropriate for this application, but a detailed review of the calculations was beyond the scope of this project. Thus, alternative 2 used a different calculation method (also a part of the CONTAM-W package) to study a different goal: whether a dual path airflow arrangement would allow natural ventilation procedures to augment simultaneous mechanical ventilation.

ALTERNATIVE 1 RESULT

The primary output from CONTAM-W is graphical. See Appendix for examples. The program displays (and allows to be saved as a bitmap) a simple plan drawing of the building taken from the Sketchpad input, with color coded lines representing flow rates and pressure differentials through airflow paths (openings) in building barriers (walls, etc). The length of each colored line represents the relative magnitude of the quantity indicated. A companion program – CONTAM-R – is similar, but displays air pressures in each zone as different colored shading.

Through all of the testing of various arrangements, results seemed to be as anticipated. The general airflow pattern through the building remained constant, with only increased flows and pressures as mechanical ventilation inputs were added to the natural ventilation baseline. The addition of mechanical (forced air) ventilation did not appear to disrupt the baseline natural patterns, implying that the pressure differentials imparted by the natural system remained in place even when fans were operating.

The next step in the evaluation, however, illustrated a problem. Numerical outputs of available pressure differentials were exported from the program to a spreadsheet (see appendix). Even with artificially high wind inputs, the maximum pressure differentials indicated were in the range of .0004 to .002 inches of water column (wg.) These are two to three orders of magnitude below the minimum needed to have any noticeable effect on fan performance. Thus, the initial theory could not be supported.

A review of the calculation procedure, which had been taken from the competition model, revealed that the value of a constant in the basic equation was a recommendation from the program's "help" file, and could need to vary significantly depending on the application. It is beyond the scope of this study to determine the suitability of this constant for this particular application.

ALTERNATIVE 2 RESULTS

The purpose of Alternative 2 was to use a different approach to verify a variant of the original theory. Instead of using pressure differentials to reduce the load on a fan, this approach would provide an alternate path for airflow so that the volume of air moved by the fan could be reduced. The critical unknown was, if by introducing forced draft ventilation, did the natural ventilation component suffer decreased performance?

In the configuration tested, as the mechanical ventilation flow rate was increased from 0% to 40% of the baseline natural ventilation rate, the natural ventilation decreased by 10%. Thus, although the natural rate decreases, there is a net gain in airflow. Moreover, plotting natural ventilation vs. wind speed vs. mechanical ventilation (fig 1) indicates that the pattern of natural ventilation change is consistent with various mechanical airflow rates, thus making possible predictions of total system performance. Practical applications of this finding are discussed in the following chapter.

CHAPTER 4

APPLICATIONS

The general principal that these findings impact is that significant energy savings can be realized by reducing the airflow rate of a fan. For idealized applications, performance equations known as “fan laws” demonstrate that the input power requirement of a fan varies as the cube of the volumetric flow rate of air moved. In the examples below, specific (real, not idealized) fan performance was modeled by a commercial computer program, the CAPS fan rating software, published by Greenheck Fan Corporation. Though this is proprietary software, the results are commonly used in the construction industry for evaluating and verifying actual fan operation in the field; this extensive experience comparing predicted performance vs. actual promotes confidence in the accuracy of the results.

EXAMPLE 1 – DUAL PATH WITH UNCONDITIONED AIR

This configuration would be the simplest mode: a fan providing unconditioned outside air to a building. This would be most applicable in climates that allowed temperature and humidity control with outside air without the need to heat or cool.

In a conventional application of this type, the fan would be sized to provide the minimum required airflow, say, for example, 5500 CFM, at all times. As the performance printout (fig 2) shows, this requires a constant power input of 5 hp with a system resistance of 1.5” wg. In an “on-off” hybrid ventilation arrangement, the fan would cycle on whenever the natural ventilation rate dropped below the 5500 CFM minimum; in the sample from the previous chapter, this would be when outside winds dropped below 9 MPH.

If the system were designed, however, for simultaneous, dual path operation, the fan would only be required to move the fraction of minimum airflow not available from the natural path. From the same sample, this would be a maximum of 2000 CFM when wind speed is ½ of a mile per hour; the performance printout (fig 3) shows this to be a power input of 1.28 hp, a reduction of 75% from the conventional hybrid. Moreover, as wind speed increases, the power input continues to drop. At wind speed of 6 MPH, the airflow required of the fan reduces to 1500 CFM and the power input (fig 4) drops an additional 58%. Also note that since the initial fan selection is for a lower capacity, the fan is physically smaller, thus reducing first cost of the construction.

A more detailed method of analyzing this concept is through the use of the fan laws, which can predict, for a specific fan, the input power requirement change with airflow change. Thus, once the initial fan selection is made and performance at design conditions established, power requirements at other airflows can be easily calculated. Taking required fan airflows (total required less portion supplied by natural ventilation) from the

sample building performance curve (fig 1), power requirements at each incremental wind speed can be established; these are multiplied times the number of hours each particular wind speed is available, and summed to establish power consumption for a given time period.
To illustrate, assume that the sample building requires 6000 CFM of ventilation air and that the design pressure resistance is 1.5” wg. A larger, more efficient fan than before is selected (fig 5), which has a power input requirement of 3.45 hp. This fan will operate either continuously (conventional construction) or on-off control (normal hybrid design). For the alternative hybrid design, the maximum required fan airflow is 2800 CFM; this selection (fig 6) has a design power requirement of 1.99 hp. For this example, wind data for January, 2010 in Aberdeen, ID is used, and building operation is assumed to be from 6 AM to 6PM, 7 days per week.

For the first arrangement (a), full design power is required for all hours of operation. For the second (b), the fan operates for only the hours when wind speed is less than 10 MPH. For the alternative hybrid (c), power is calculated for each wind speed increment and summed.

a) Conventional Construction (No Natural Component)

$$3.45HP \times .746\frac{KW}{HP} \times 372hours = 957KWH$$

b) “Normal” Hybrid Ventilation (on-off control)

$$3.45HP \times .746\frac{KW}{HP} \times (372-73)hours = 770KWH$$

c) Alternative Hybrid Ventilation

≤ 3 MPH	$1.99HP \times .746\frac{KW}{HP} \times (31+23)\,hours = 87.6KWH$
4 MPH	$1.99HP \times \left[\frac{2700}{2800}\right]^3 \times .746\frac{KW}{HP} \times (60)\,hours = 66.6KWH$
5 MPH	$1.99HP \times \left[\frac{2400}{2800}\right]^3 \times .746\frac{KW}{HP} \times (42)\,hours = 46.7KWH$
6 MPH	$1.99HP \times \left[\frac{2000}{2800}\right]^3 \times .746\frac{KW}{HP} \times (45)\,hours = 45.5KWH$
7 MPH	$1.99HP \times \left[\frac{1500}{2800}\right]^3 \times .746\frac{KW}{HP} \times (47)\,hours = 10.7KWH$
8 MPH	$1.99HP \times \left[\frac{1300}{2800}\right]^3 \times .746\frac{KW}{HP} \times (32)\,hours = 4.75KWH$
9 MPH	$1.99HP \times \left[\frac{400}{2800}\right]^3 \times .746\frac{KW}{HP} \times (24)\,hours = 0.1KWH$
TOTAL	262 KWH

“Conventional” to “Normal Hybrid” = 20% reduction

“ Normal” to “Alternative” Hybrid = 66% reduction

Table 1 - Hourly Wind Speed Summary 6 am – 6 pm Aberdeen, ID – January 2010

Day	Hours								
	<3 mph	**3 mph**	**4 mph**	**5 mph**	**6 mph**	**7 mph**	**8 mph**	**9 mph**	**>10 mph**
1	3	4	0	0	1	1	2	0	1
2	0	0	0	1	1	2	2	2	4
3	5	4	2	1	0	0	0	0	0
4	1	1	1	2	1	1	0	3	2
5	4	0	2	0	1	0	1	2	2
6	0	0	0	0	0	1	0	0	11
7	0	3	3	1	2	3	0	0	0
8	0	0	0	3	2	2	1	1	3
9	0	0	3	1	2	3	2	1	0
10	0	2	1	3	3	1	0	1	1
11	2	2	1	0	4	1	2	0	0
12	0	1	1	2	2	0	2	1	3
13	3	1	3	0	0	4	0	1	0
14	1	0	0	0	0	3	1	4	3
15	1	0	4	2	0	1	1	1	2
16	0	0	5	2	3	0	2	0	0
17	1	3	1	1	1	4	1	0	0
18	3	1	0	3	3	1	1	0	0
19	0	1	0	3	1	2	1	1	3
20	1	0	4	3	1	3	0	0	0
21	3	2	4	1	2	0	0	0	0
22	0	0	0	0	0	1	0	2	9
23	0	0	0	0	0	0	0	0	12
24	0	0	2	0	1	1	4	2	2
25	0	1	1	4	0	3	1	0	2
26	1	1	0	4	3	1	1	0	1
27	0	1	3	2	2	3	1	0	0
28	1	0	4	1	4	1	1	0	0
29	0	0	4	2	3	2	1	0	0
30	1	0	1	0	2	1	0	2	5
31	0	0	0	0	0	1	4	0	7
TOTALS	31	28	50	42	45	47	32	24	73

Another way to look at this calculation, and to easily compare results from different locations, is to place the same equations in a spreadsheet (see Table 2) and paste in hourly wind data from the TMY3 weather records (www.nrel.gov). (In this case, 24 hour/day, full year data is used instead of the 12 hour/day, one month used in the earlier example) Table 3 shows results for various U.S. cities in differing regions and climates.

Table 2 – Atlanta Data

Dual Path

Windspeed	Counts	Max Motor HP	Mechanical Airflow	Max Mechanical Airflow	Airflow Fraction	Fan Law Cube	HP-KW Conversion	KWH
< or = 3	750	2	2800	2800	1.000	1.000	0.746	559.5
4	0	2	2700	2800	0.964	0.897	0.669	0
5	751	2	2400	2800	0.857	0.630	0.470	352.8
6	942	2	2000	2800	0.714	0.364	0.272	256.1
7	1051	2	1500	2800	0.536	0.154	0.115	120.5
8	960	2	1300	2800	0.464	0.100	0.075	71.7
9	1093	2	400	2800	0.143	0.003	0.002	2.4
> or = 10	3213	2	0	2800	0.000	0.000	0.000	0
TOTAL KWH								1363

On-Off Control

TOTAL Counts <10 MPH	5547	3.45					2.574	14276.3
PERCENTAGE SAVINGS	**90.45%**							

Table 3 – Sample Savings by City

City	Percent Savings
Los Angeles	85.8%
Houston	87.3%
Miami	87.7%
Denver	88.4%
Seattle	89.5%
Philadelphia	90.0%
Atlanta	90.5%
Chicago	90.7%
Kansas City	91.0%
Boston	93.0%

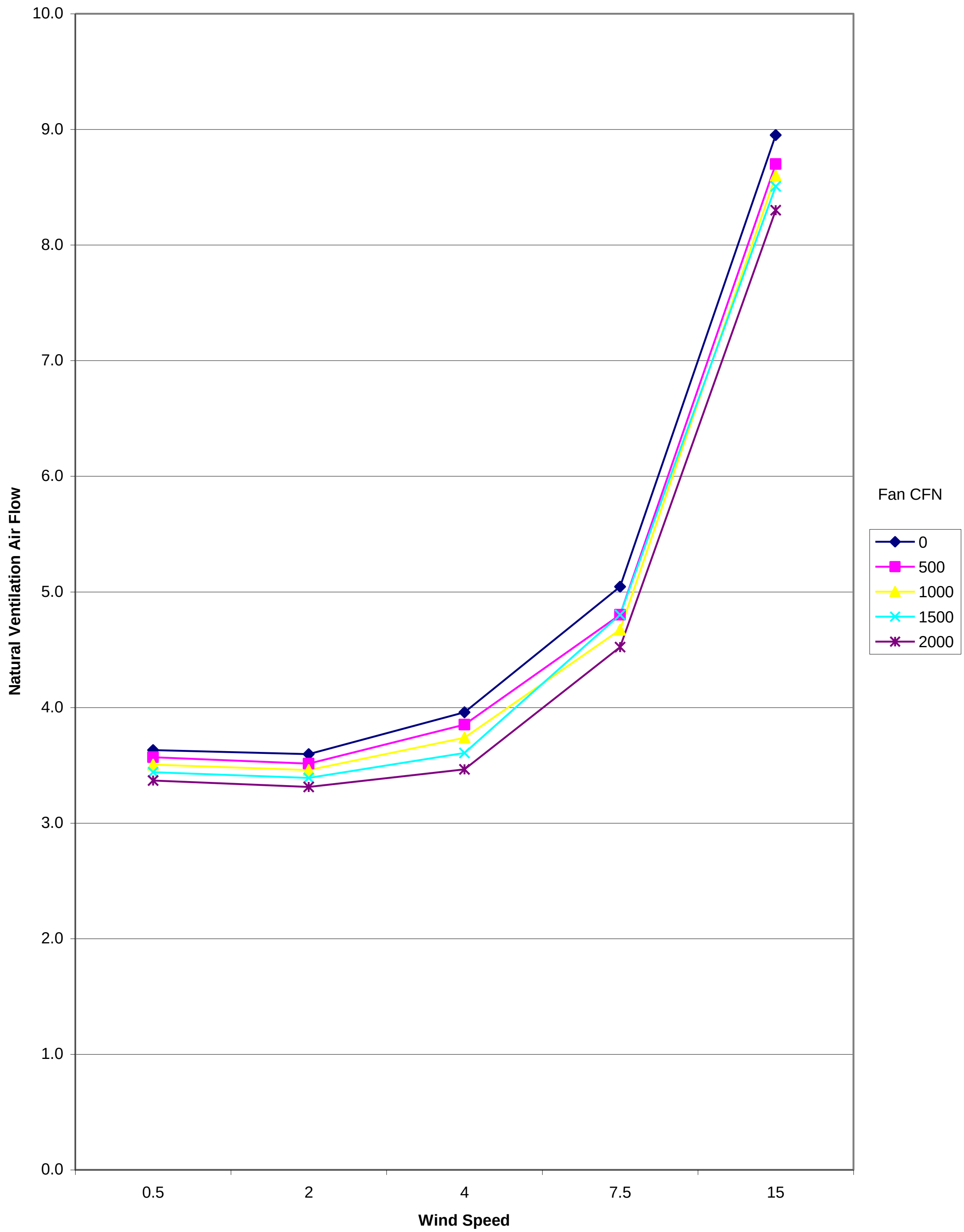


Figure 1 – Building Performance Curve

EXAMPLE 2 – DUAL PATH WITH CONDITIONED AIR

More complexity is required when local climate conditions require the air to be treated – heated, cooled, dehumidified. Performing these functions typically requires adding appurtenances, such as water or refrigerant coils, combustion fuel heat exchangers, or electric heating elements, to the airflow path. These items cause resistance to the airflow which can exceed the pressure difference provided by the natural ventilation system.

Similar savings as with the first mode would result from using the same arrangement, but with the conditioning elements (heating/cooling coils, etc.) in the fan path. Air in the "mechanical path" would be heated or cooled to a greater degree than normal, then mixed with the "natural path" air to provide a total air quantity capable of conditioning the building interior.

Similar arrangements, also called "dual path" or sometimes "split dehumidification unit", are used in conventional HVAC systems because of advantages of degree of control and savings of primary energy. In a typical conventional dehumidification application, system control is often provided by "face and by-pass" dampers; a fixed speed fan determines a total airflow rate, and modulating dampers adjust which amounts travel through the coils and which is by-passed. The air through the coil is cooled to a low dewpoint, removing moisture through condensation, and the by-passed air mixes with it to provide sensible reheat.

By splitting these functions out of a single air handling unit and putting them in our dual natural/mechanical arrangement, the control would be provided by the variable capacity fan (thus eliminating the dampers and their associated first cost and energy consuming airflow resistance). The advantages of the conventional system would be retained, and the transport energy savings of the first mode would also be available in mechanically conditioned systems. This would allow the system to be applied in climates not normally suitable for natural ventilation (i.e., hot and humid) while still providing significant savings in transport energy.

COMMON ADVANTAGES

In both arrangements, the transport energy savings is similar. In a sense, there are two "fans": the mechanical one with motor power input, and the natural one requiring no power input. By reducing the airflow handled by the fan, the power is reduced by a significant (cube function) amount.

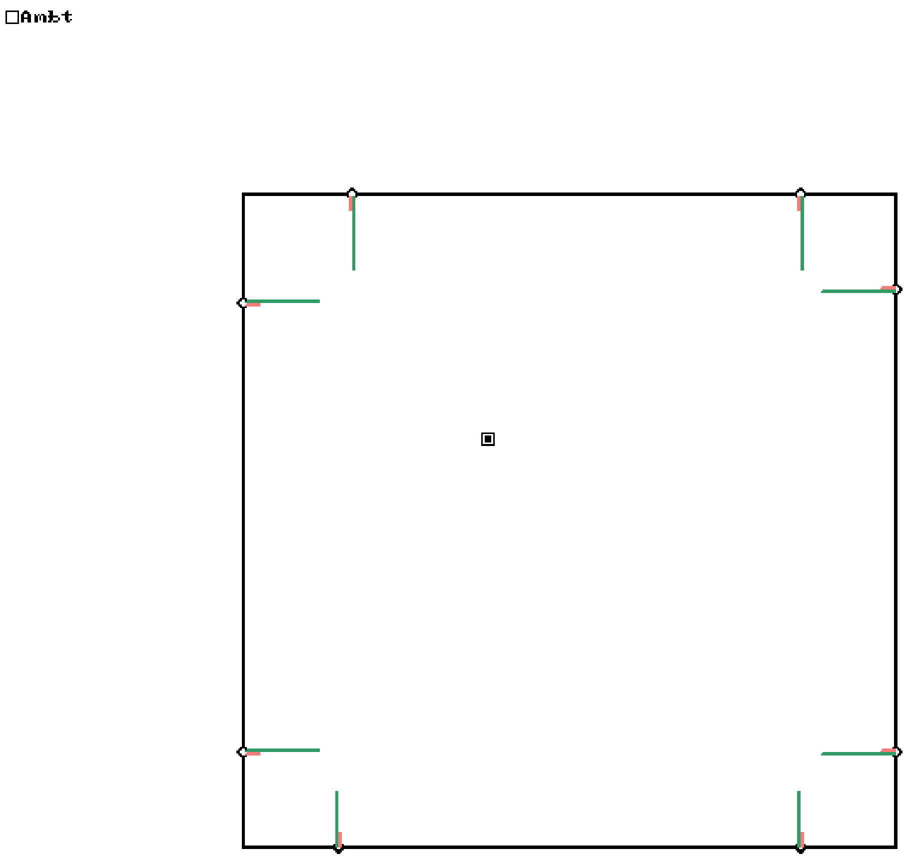
Typically, energy saving innovations require a cost premium – compared to conventional -- to install, with the operating cost savings providing a "pay-back" over time. With this concept, however, the initial cost add may be negligible, or even a reduction. The mechanical portion should always be a smaller fan with a smaller motor, which in turn requires a smaller electrical service, all leading to a smaller up-front cost. This applies to both the conditioned and unconditioned air modes. Architectural features that enable natural airflow may or may not cost more than "conventional" construction, depending on the methods employed.

Care should be used when applying these results to other building designs. All of the performance calculations used in this study were based on a sample building specifically designed for natural ventilation. In particular, a fully symmetrical structure is assumed so that variations in wind direction are not considered. That being said, this concept's intent is to improve the performance of non-optimum natural ventilation applications; the principles should be considered for a particular design more so than the exact percentages found here.

APPENDIX A

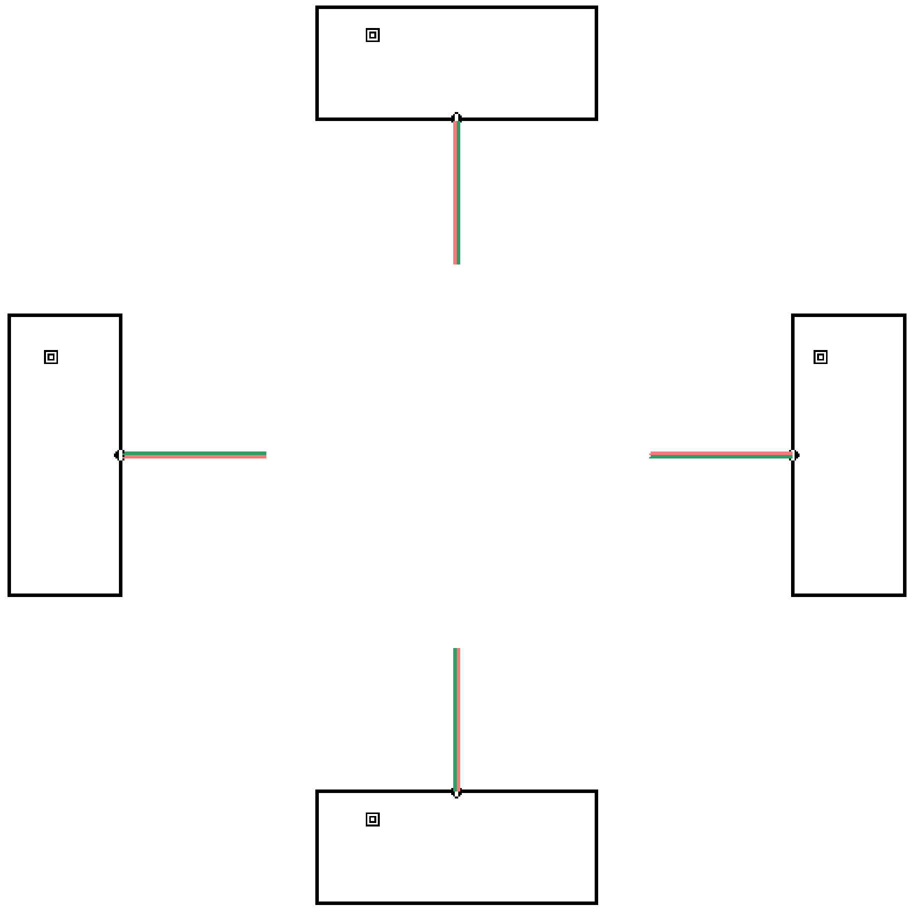
TYPICAL CONTAM – W GRAPHICAL OUTPUTS

BASELINE LEVEL BOTTOM



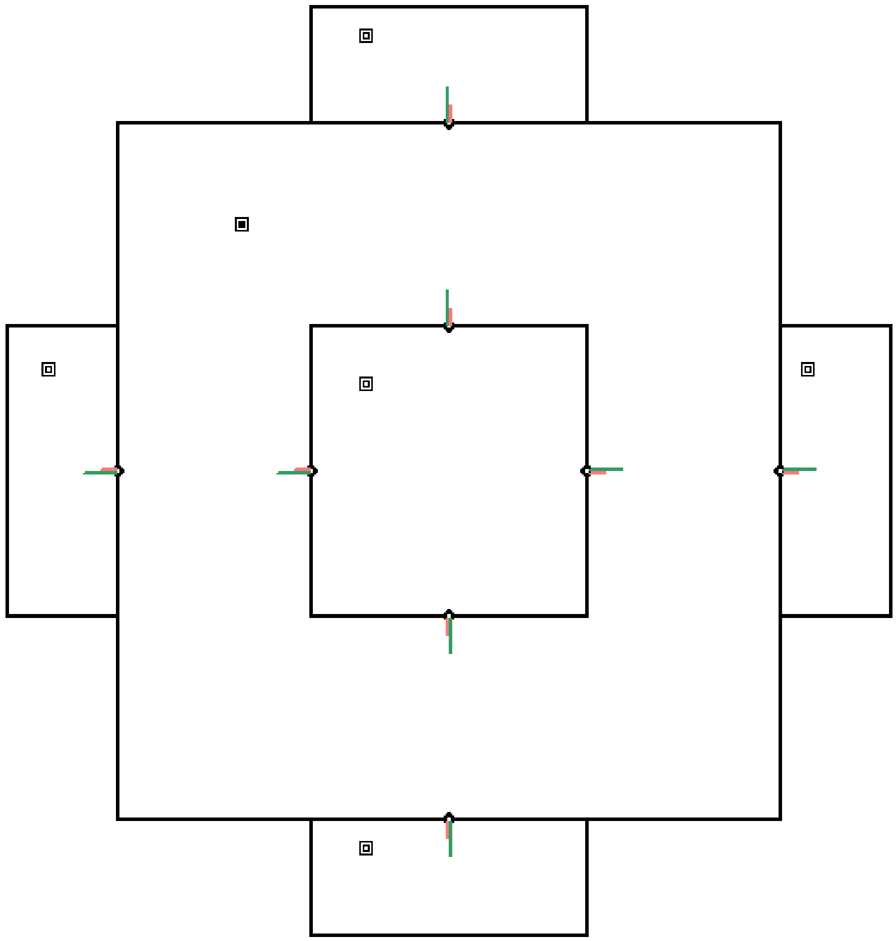
BASELINE LEVEL TOP

□Ambt

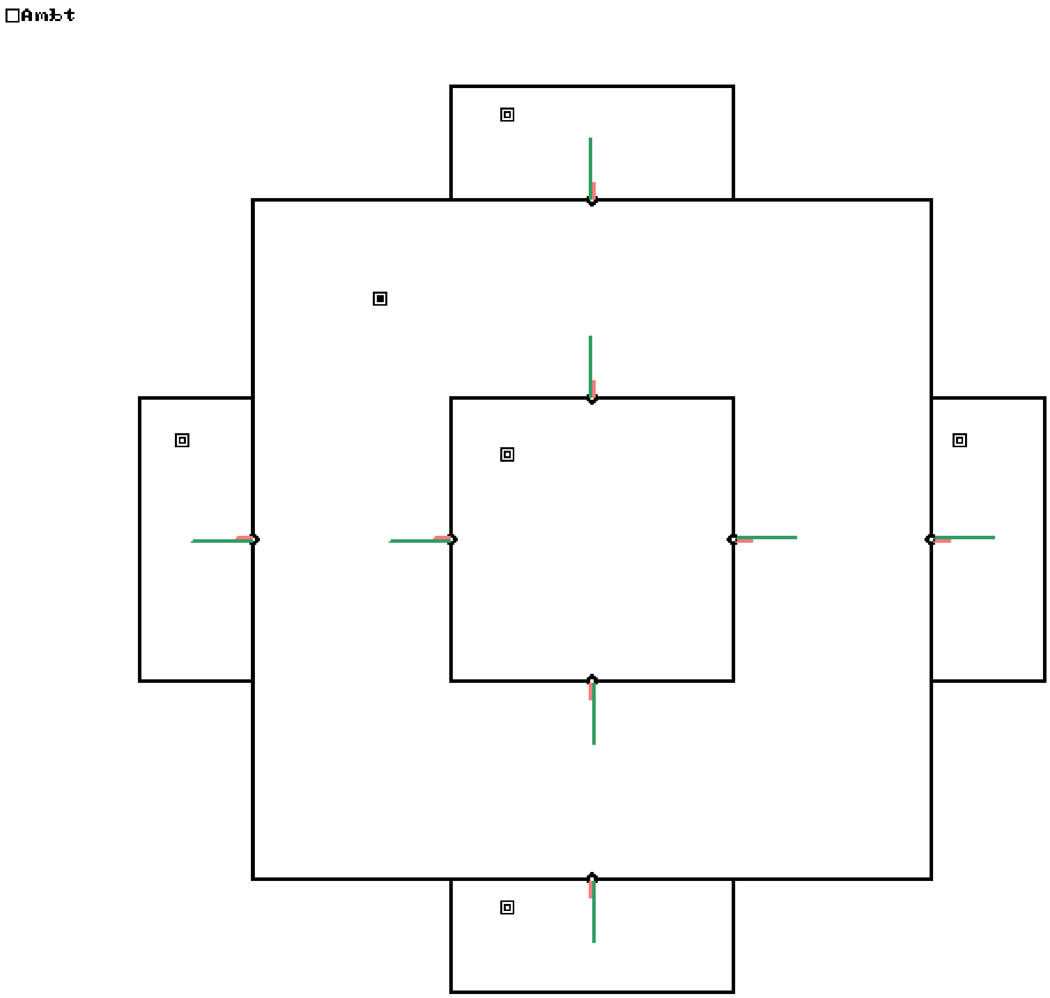


BASELINE LEVEL 2

□Ambt



BASELINE LEVEL 3



APPENDIX B

CONTAM-W TEXT OUTPUTS

PROJECT: BASELINEF1 **FRI JAN 15 15:07:02 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 15.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.012	68.0	3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			Filter	Ambt	0.014	1202.70	
			Filter	Ambt	0.014	1202.70	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.012	1029.41	
			Filter	Ambt	0.012	1029.41	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.011	68.0	VentOutlet	Ambt	-0.000	-752.79	219.25
			3Floor_Conn	Main/<3>	0.000	224.65	
			2Floor_Conn	Main/<2>	0.000	131.04	

```
                1Floor_Conn  Main/<1>     0.000     177.84

Main   -0.011   68.0  1Floor_Conn  VentStack_N/<1>    -0.000    -177.84
                1Floor_Conn  LightWell/<0>     0.000     745.96
                1Floor_Conn  VentStack_W/<1>    -0.001   -1403.16
                1Floor_Conn  LightWell/<0>     0.000     745.96
                1Floor_Conn  LightWell/<0>     0.000     745.96
                1Floor_Conn  VentStack_E/<1>    -0.001   -1403.16
                1Floor_Conn  LightWell/<0>     0.000     745.96
                1Floor_Conn  VentStack_S/<1>     0.000      0.34

VentStack_W   -0.012   68.0  VentOutlet     Ambt      -0.006   -4209.49
                3Floor_Conn  Main/<3>     0.001    1772.42
                2Floor_Conn  Main/<2>     0.001    1033.91
                1Floor_Conn  Main/<1>     0.001    1403.16

VentStack_E   -0.012   68.0  VentOutlet     Ambt      -0.006   -4209.49
                3Floor_Conn  Main/<3>     0.001    1772.42
                2Floor_Conn  Main/<2>     0.001    1033.91
                1Floor_Conn  Main/<1>     0.001    1403.16

VentStack_S   -0.011   68.0  BackdraftRoof   Ambt      0.037      1.01
                3Floor_Conn  Main/<3>    -0.000     -0.43
                2Floor_Conn  Main/<2>    -0.000     -0.25
                1Floor_Conn  Main/<1>    -0.000     -0.34

level: <2>    elevation: 13.1 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.009   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -131.04
                2Floor_Conn  LightWell/<0>     0.000     549.66
                2Floor_Conn  VentStack_W/<1>    -0.001   -1033.91
                2Floor_Conn  LightWell/<0>     0.000     549.66
                2Floor_Conn  LightWell/<0>     0.000     549.66
                2Floor_Conn  VentStack_E/<1>    -0.001   -1033.91
                2Floor_Conn  LightWell/<0>     0.000     549.66
                2Floor_Conn  VentStack_S/<1>     0.000      0.25

level: <3>    elevation: 23.0 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.007   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -224.65
                3Floor_Conn  LightWell/<0>     0.000     942.26
                3Floor_Conn  VentStack_W/<1>    -0.001   -1772.42
                3Floor_Conn  LightWell/<0>     0.000     942.26
                3Floor_Conn  LightWell/<0>     0.000     942.26
```

3Floor_Conn	VentStack_E/<1>	-0.001	-1772.42
3Floor_Conn	LightWell/<0>	0.000	942.26
3Floor_Conn	VentStack_S/<1>	0.000	0.43

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET.5 **TUE FEB 09 11:30:12 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-382.22	
			3Floor_Conn	Main/<3>	-0.000	-382.22	
			3Floor_Conn	Main/<3>	-0.000	-382.22	
			3Floor_Conn	Main/<3>	-0.000	-382.22	
			2Floor_Conn	Main/<2>	-0.000	-222.96	
			2Floor_Conn	Main/<2>	-0.000	-222.96	
			2Floor_Conn	Main/<2>	-0.000	-222.96	
			2Floor_Conn	Main/<2>	-0.000	-222.96	
			1Floor_Conn	Main/<1>	-0.000	-302.59	
			1Floor_Conn	Main/<1>	-0.000	-302.59	
			1Floor_Conn	Main/<1>	-0.000	-302.59	
			1Floor_Conn	Main/<1>	-0.000	-302.59	
			Filter	Ambt	0.007	453.96	
			Filter	Ambt	0.007	453.96	
			Filter	Ambt	0.007	453.87	
			Filter	Ambt	0.007	453.87	
			Closed	Ambt	0.006	0.21	
			Filter	Ambt	0.007	453.87	
			Filter	Ambt	0.007	453.87	
			Filter	Ambt	0.007	453.76	
			Filter	Ambt	0.007	453.76	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.000	-939.66	111.15
			3Floor_Conn	Main/<3>	0.000	348.85	
			2Floor_Conn	Main/<2>	0.000	203.49	
			1Floor_Conn	Main/<1>	0.000	276.17	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-276.17	

			1Floor_Conn	LightWell/<0>	0.000	302.59	
			1Floor_Conn	VentStack_W/<1>	-0.000	-280.46	
			1Floor_Conn	LightWell/<0>	0.000	302.59	
			1Floor_Conn	LightWell/<0>	0.000	302.59	
			1Floor_Conn	VentStack_E/<1>	-0.000	-280.46	
			1Floor_Conn	LightWell/<0>	0.000	302.59	
			1Floor_Conn	VentStack_S/<1>	-0.000	-373.27	
VentStack_W	-0.006	68.0	VentOutlet	Ambt	-0.000	-948.31	106.92
			3Floor_Conn	Main/<3>	0.000	354.27	
			2Floor_Conn	Main/<2>	0.000	206.66	
			1Floor_Conn	Main/<1>	0.000	280.46	
VentStack_E	-0.006	68.0	VentOutlet	Ambt	-0.000	-948.31	106.92
			3Floor_Conn	Main/<3>	0.000	354.27	
			2Floor_Conn	Main/<2>	0.000	206.66	
			1Floor_Conn	Main/<1>	0.000	280.46	
VentStack_S	-0.006	68.0	BackdraftRoof	Ambt	-0.000	-1119.81	
			3Floor_Conn	Main/<3>	0.000	471.50	
			2Floor_Conn	Main/<2>	0.000	275.04	
			1Floor_Conn	Main/<1>	0.000	373.27	

level: <2> elevation: 13.1 ft

zone	P	T	path	from	dP	Flow1	Flow2
Main	-0.004	68.0	2Floor_Conn	VentStack_N/<1>	-0.000	-203.49	
			2Floor_Conn	LightWell/<0>	0.000	222.96	
			2Floor_Conn	VentStack_W/<1>	-0.000	-206.66	
			2Floor_Conn	LightWell/<0>	0.000	222.96	
			2Floor_Conn	LightWell/<0>	0.000	222.96	
			2Floor_Conn	VentStack_E/<1>	-0.000	-206.66	
			2Floor_Conn	LightWell/<0>	0.000	222.96	
			2Floor_Conn	VentStack_S/<1>	-0.000	-275.04	

level: <3> elevation: 23.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
Main	-0.002	68.0	3Floor_Conn	VentStack_N/<1>	-0.000	-348.85	
			3Floor_Conn	LightWell/<0>	0.000	382.22	
			3Floor_Conn	VentStack_W/<1>	-0.000	-354.27	
			3Floor_Conn	LightWell/<0>	0.000	382.22	
			3Floor_Conn	LightWell/<0>	0.000	382.22	
			3Floor_Conn	VentStack_E/<1>	-0.000	-354.27	
			3Floor_Conn	LightWell/<0>	0.000	382.22	
			3Floor_Conn	VentStack_S/<1>	-0.000	-471.50	

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET.5+FAN.5 **TUE FEB 09 11:56:02 2010**
description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			Filter	Ambt	0.007	446.35	
			Filter	Ambt	0.007	446.35	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.26	
			Fan.5	Ambt	0.006	506.56	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.16	
			Filter	Ambt	0.007	446.16	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.000	-1014.62	76.73
			3Floor_Conn	Main/<3>	0.000	394.90	
			2Floor_Conn	Main/<2>	0.000	230.36	
			1Floor_Conn	Main/<1>	0.000	312.63	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-312.63	

```
              1Floor_Conn  LightWell/<0>    0.000    339.72
              1Floor_Conn  VentStack_W/<1>   -0.000   -316.77
              1Floor_Conn  LightWell/<0>    0.000    339.72
              1Floor_Conn  LightWell/<0>    0.000    339.72
              1Floor_Conn  VentStack_E/<1>   -0.000   -316.77
              1Floor_Conn  LightWell/<0>    0.000    339.72
              1Floor_Conn  VentStack_S/<1>   -0.000   -412.69

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.000   -1023.38     73.05
              3Floor_Conn  Main/<3>    0.000    400.14
              2Floor_Conn  Main/<2>    0.000    233.41
              1Floor_Conn  Main/<1>    0.000    316.77

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.000   -1023.38     73.05
              3Floor_Conn  Main/<3>    0.000    400.14
              2Floor_Conn  Main/<2>    0.000    233.41
              1Floor_Conn  Main/<1>    0.000    316.77

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000   -1238.07
              3Floor_Conn  Main/<3>    0.000    521.29
              2Floor_Conn  Main/<2>    0.000    304.09
              1Floor_Conn  Main/<1>    0.000    412.69

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -230.36
              2Floor_Conn  LightWell/<0>    0.000    250.32
              2Floor_Conn  VentStack_W/<1>   -0.000   -233.41
              2Floor_Conn  LightWell/<0>    0.000    250.32
              2Floor_Conn  LightWell/<0>    0.000    250.32
              2Floor_Conn  VentStack_E/<1>   -0.000   -233.41
              2Floor_Conn  LightWell/<0>    0.000    250.32
              2Floor_Conn  VentStack_S/<1>   -0.000   -304.09

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -394.90
              3Floor_Conn  LightWell/<0>    0.000    429.12
              3Floor_Conn  VentStack_W/<1>   -0.000   -400.14
              3Floor_Conn  LightWell/<0>    0.000    429.12
              3Floor_Conn  LightWell/<0>    0.000    429.12
              3Floor_Conn  VentStack_E/<1>   -0.000   -400.14
              3Floor_Conn  LightWell/<0>    0.000    429.12
              3Floor_Conn  VentStack_S/<1>   -0.000   -521.29
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:

flows in scfm

pressures in in.H2O

temperatures in °F

- indicates limit exceeded

PROJECT: FILTERINLET.5+FAN1 TUE FEB 09 11:54:41 2010

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-475.75	
			3Floor_Conn	Main/<3>	-0.000	-475.75	
			3Floor_Conn	Main/<3>	-0.000	-475.75	
			3Floor_Conn	Main/<3>	-0.000	-475.75	
			2Floor_Conn	Main/<2>	-0.000	-277.52	
			2Floor_Conn	Main/<2>	-0.000	-277.52	
			2Floor_Conn	Main/<2>	-0.000	-277.52	
			2Floor_Conn	Main/<2>	-0.000	-277.52	
			1Floor_Conn	Main/<1>	-0.000	-376.63	
			1Floor_Conn	Main/<1>	-0.000	-376.63	
			1Floor_Conn	Main/<1>	-0.000	-376.63	
			1Floor_Conn	Main/<1>	-0.000	-376.63	
			Filter	Ambt	0.007	438.40	
			Filter	Ambt	0.007	438.40	
			Filter	Ambt	0.007	438.31	
			Filter	Ambt	0.007	438.31	
			Fan1	Ambt	0.006	1013.11	
			Filter	Ambt	0.007	438.31	
			Filter	Ambt	0.007	438.31	
			Filter	Ambt	0.007	438.21	
			Filter	Ambt	0.007	438.21	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1093.28	46.22
			3Floor_Conn	Main/<3>	0.000	440.87	
			2Floor_Conn	Main/<2>	0.000	257.17	
			1Floor_Conn	Main/<1>	0.000	349.02	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-349.02	

```
                  1Floor_Conn  LightWell/<0>     0.000     376.63
                  1Floor_Conn  VentStack_W/<1>    -0.000    -353.00
                  1Floor_Conn  LightWell/<0>     0.000     376.63
                  1Floor_Conn  LightWell/<0>     0.000     376.63
                  1Floor_Conn  VentStack_E/<1>    -0.000    -353.00
                  1Floor_Conn  LightWell/<0>     0.000     376.63
                  1Floor_Conn  VentStack_S/<1>    -0.000    -451.50

VentStack_W   -0.006   68.0  VentOutlet     Ambt     -0.001   -1102.17     43.16
                  3Floor_Conn  Main/<3>    0.000     445.90
                  2Floor_Conn  Main/<2>    0.000     260.11
                  1Floor_Conn  Main/<1>    0.000     353.00

VentStack_E   -0.006   68.0  VentOutlet     Ambt     -0.001   -1102.17     43.16
                  3Floor_Conn  Main/<3>    0.000     445.90
                  2Floor_Conn  Main/<2>    0.000     260.11
                  1Floor_Conn  Main/<1>    0.000     353.00

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000   -1354.51
                  3Floor_Conn  Main/<3>    0.000     570.32
                  2Floor_Conn  Main/<2>    0.000     332.69
                  1Floor_Conn  Main/<1>    0.000     451.50

level: <2>    elevation: 13.1 ft

zone     P      T      path        from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -257.17
                  2Floor_Conn  LightWell/<0>     0.000     277.52
                  2Floor_Conn  VentStack_W/<1>    -0.000    -260.11
                  2Floor_Conn  LightWell/<0>     0.000     277.52
                  2Floor_Conn  LightWell/<0>     0.000     277.52
                  2Floor_Conn  VentStack_E/<1>    -0.000    -260.11
                  2Floor_Conn  LightWell/<0>     0.000     277.52
                  2Floor_Conn  VentStack_S/<1>    -0.000    -332.69

level: <3>    elevation: 23.0 ft

zone     P      T      path        from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -440.87
                  3Floor_Conn  LightWell/<0>     0.000     475.75
                  3Floor_Conn  VentStack_W/<1>    -0.000    -445.90
                  3Floor_Conn  LightWell/<0>     0.000     475.75
                  3Floor_Conn  LightWell/<0>     0.000     475.75
                  3Floor_Conn  VentStack_E/<1>    -0.000    -445.90
                  3Floor_Conn  LightWell/<0>     0.000     475.75
                  3Floor_Conn  VentStack_S/<1>    -0.000    -570.32
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET.5+FAN1.5 **TUE FEB 09 11:57:15 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-522.06	
			3Floor_Conn	Main/<3>	-0.000	-522.06	
			3Floor_Conn	Main/<3>	-0.000	-522.06	
			3Floor_Conn	Main/<3>	-0.000	-522.06	
			2Floor_Conn	Main/<2>	-0.000	-304.54	
			2Floor_Conn	Main/<2>	-0.000	-304.54	
			2Floor_Conn	Main/<2>	-0.000	-304.54	
			2Floor_Conn	Main/<2>	-0.000	-304.54	
			1Floor_Conn	Main/<1>	-0.000	-413.30	
			1Floor_Conn	Main/<1>	-0.000	-413.30	
			1Floor_Conn	Main/<1>	-0.000	-413.30	
			1Floor_Conn	Main/<1>	-0.000	-413.30	
			Filter	Ambt	0.007	430.08	
			Filter	Ambt	0.007	430.08	
			Filter	Ambt	0.007	429.99	
			Filter	Ambt	0.007	429.99	
			Fan1.5	Ambt	0.006	1519.66	
			Filter	Ambt	0.007	429.99	
			Filter	Ambt	0.007	429.99	
			Filter	Ambt	0.007	429.89	
			Filter	Ambt	0.007	429.89	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1176.32	20.74
			3Floor_Conn	Main/<3>	0.000	486.56	
			2Floor_Conn	Main/<2>	0.000	283.83	
			1Floor_Conn	Main/<1>	0.000	385.20	

Main -0.006 68.0 1Floor_Conn VentStack_N/<1> -0.000 -385.20

```
                  1Floor_Conn  LightWell/<0>    0.000    413.30
                  1Floor_Conn  VentStack_W/<1>   -0.000   -388.98
                  1Floor_Conn  LightWell/<0>    0.000    413.30
                  1Floor_Conn  LightWell/<0>    0.000    413.30
                  1Floor_Conn  VentStack_E/<1>   -0.000   -388.98
                  1Floor_Conn  LightWell/<0>    0.000    413.30
                  1Floor_Conn  VentStack_S/<1>   -0.000   -490.04

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1185.35     18.42
                  3Floor_Conn  Main/<3>    0.000    491.34
                  2Floor_Conn  Main/<2>    0.000    286.62
                  1Floor_Conn  Main/<1>    0.000    388.98

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1185.35     18.42
                  3Floor_Conn  Main/<3>    0.000    491.34
                  2Floor_Conn  Main/<2>    0.000    286.62
                  1Floor_Conn  Main/<1>    0.000    388.98

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000   -1470.11
                  3Floor_Conn  Main/<3>    0.000    619.00
                  2Floor_Conn  Main/<2>    0.000    361.08
                  1Floor_Conn  Main/<1>    0.000    490.04

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -283.83
                  2Floor_Conn  LightWell/<0>    0.000    304.54
                  2Floor_Conn  VentStack_W/<1>   -0.000   -286.62
                  2Floor_Conn  LightWell/<0>    0.000    304.54
                  2Floor_Conn  LightWell/<0>    0.000    304.54
                  2Floor_Conn  VentStack_E/<1>   -0.000   -286.62
                  2Floor_Conn  LightWell/<0>    0.000    304.54
                  2Floor_Conn  VentStack_S/<1>   -0.000   -361.08

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -486.56
                  3Floor_Conn  LightWell/<0>    0.000    522.06
                  3Floor_Conn  VentStack_W/<1>   -0.000   -491.34
                  3Floor_Conn  LightWell/<0>    0.000    522.06
                  3Floor_Conn  LightWell/<0>    0.000    522.06
                  3Floor_Conn  VentStack_E/<1>   -0.000   -491.34
                  3Floor_Conn  LightWell/<0>    0.000    522.06
                  3Floor_Conn  VentStack_S/<1>   -0.000   -619.00
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

project: **FilterInlet.5+Fan2** **Tue Feb 09 11:58:27 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0>   elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.006	68.0	3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			Filter	Ambt	0.006	421.28	
			Filter	Ambt	0.006	421.28	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.19	
			Fan2	Ambt	0.006	2026.22	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.09	
			Filter	Ambt	0.006	421.09	

level: <1>   elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1265.49	2.74
			3Floor_Conn	Main/<3>	0.000	531.68	
			2Floor_Conn	Main/<2>	0.000	310.15	
			1Floor_Conn	Main/<1>	0.000	420.92	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-420.92	
			1Floor_Conn	LightWell/<0>	0.000	449.64	

```
                1Floor_Conn  VentStack_W/<1>   -0.000   -424.37
                1Floor_Conn  LightWell/<0>    0.000    449.64
                1Floor_Conn  LightWell/<0>    0.000    449.64
                1Floor_Conn  VentStack_E/<1>   -0.000   -424.37
                1Floor_Conn  LightWell/<0>    0.000    449.64
                1Floor_Conn  VentStack_S/<1>   -0.000   -528.91

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1274.75      1.63
                3Floor_Conn  Main/<3>    0.000    536.05
                2Floor_Conn  Main/<2>    0.000    312.70
                1Floor_Conn  Main/<1>    0.000    424.37

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1274.75      1.63
                3Floor_Conn  Main/<3>    0.000    536.05
                2Floor_Conn  Main/<2>    0.000    312.70
                1Floor_Conn  Main/<1>    0.000    424.37

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.001   -1586.74
                3Floor_Conn  Main/<3>    0.000    668.10
                2Floor_Conn  Main/<2>    0.000    389.73
                1Floor_Conn  Main/<1>    0.000    528.91

level: <2>    elevation: 13.1 ft

zone     P     T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -310.15
                2Floor_Conn  LightWell/<0>    0.000    331.32
                2Floor_Conn  VentStack_W/<1>   -0.000   -312.70
                2Floor_Conn  LightWell/<0>    0.000    331.32
                2Floor_Conn  LightWell/<0>    0.000    331.32
                2Floor_Conn  VentStack_E/<1>   -0.000   -312.70
                2Floor_Conn  LightWell/<0>    0.000    331.32
                2Floor_Conn  VentStack_S/<1>   -0.000   -389.73

level: <3>    elevation: 23.0 ft

zone     P     T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -531.68
                3Floor_Conn  LightWell/<0>    0.000    567.97
                3Floor_Conn  VentStack_W/<1>   -0.000   -536.05
                3Floor_Conn  LightWell/<0>    0.000    567.97
                3Floor_Conn  LightWell/<0>    0.000    567.97
                3Floor_Conn  VentStack_E/<1>   -0.000   -536.05
                3Floor_Conn  LightWell/<0>    0.000    567.97
                3Floor_Conn  VentStack_S/<1>   -0.000   -668.10
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

project: FilterInlet.5+Fan.5 **Tue Feb 09 11:56:02 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			3Floor_Conn	Main/<3>	-0.000	-429.12	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			2Floor_Conn	Main/<2>	-0.000	-250.32	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			1Floor_Conn	Main/<1>	-0.000	-339.72	
			Filter	Ambt	0.007	446.35	
			Filter	Ambt	0.007	446.35	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.26	
			Fan.5	Ambt	0.006	506.56	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.26	
			Filter	Ambt	0.007	446.16	
			Filter	Ambt	0.007	446.16	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.000	-1014.62	76.73
			3Floor_Conn	Main/<3>	0.000	394.90	
			2Floor_Conn	Main/<2>	0.000	230.36	
			1Floor_Conn	Main/<1>	0.000	312.63	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-312.63	
			1Floor_Conn	LightWell/<0>	0.000	339.72	

```
                 1Floor_Conn  VentStack_W/<1>    -0.000    -316.77
                 1Floor_Conn  LightWell/<0>     0.000     339.72
                 1Floor_Conn  LightWell/<0>     0.000     339.72
                 1Floor_Conn  VentStack_E/<1>    -0.000    -316.77
                 1Floor_Conn  LightWell/<0>     0.000     339.72
                 1Floor_Conn  VentStack_S/<1>    -0.000    -412.69

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.000   -1023.38     73.05
                 3Floor_Conn  Main/<3>    0.000     400.14
                 2Floor_Conn  Main/<2>    0.000     233.41
                 1Floor_Conn  Main/<1>    0.000     316.77

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.000   -1023.38     73.05
                 3Floor_Conn  Main/<3>    0.000     400.14
                 2Floor_Conn  Main/<2>    0.000     233.41
                 1Floor_Conn  Main/<1>    0.000     316.77

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000   -1238.07
                 3Floor_Conn  Main/<3>    0.000     521.29
                 2Floor_Conn  Main/<2>    0.000     304.09
                 1Floor_Conn  Main/<1>    0.000     412.69

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -230.36
                 2Floor_Conn  LightWell/<0>     0.000     250.32
                 2Floor_Conn  VentStack_W/<1>    -0.000    -233.41
                 2Floor_Conn  LightWell/<0>     0.000     250.32
                 2Floor_Conn  LightWell/<0>     0.000     250.32
                 2Floor_Conn  VentStack_E/<1>    -0.000    -233.41
                 2Floor_Conn  LightWell/<0>     0.000     250.32
                 2Floor_Conn  VentStack_S/<1>    -0.000    -304.09

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -394.90
                 3Floor_Conn  LightWell/<0>     0.000     429.12
                 3Floor_Conn  VentStack_W/<1>    -0.000    -400.14
                 3Floor_Conn  LightWell/<0>     0.000     429.12
                 3Floor_Conn  LightWell/<0>     0.000     429.12
                 3Floor_Conn  VentStack_E/<1>    -0.000    -400.14
                 3Floor_Conn  LightWell/<0>     0.000     429.12
                 3Floor_Conn  VentStack_S/<1>    -0.000    -521.29
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET.5+FAN2 TUE FEB 09 11:58:27 2010

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 0.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.006	68.0	3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			3Floor_Conn	Main/<3>	-0.000	-567.97	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			2Floor_Conn	Main/<2>	-0.000	-331.32	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			1Floor_Conn	Main/<1>	-0.000	-449.64	
			Filter	Ambt	0.006	421.28	
			Filter	Ambt	0.006	421.28	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.19	
			Fan2	Ambt	0.006	2026.22	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.19	
			Filter	Ambt	0.006	421.09	
			Filter	Ambt	0.006	421.09	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1265.49	2.74
			3Floor_Conn	Main/<3>	0.000	531.68	
			2Floor_Conn	Main/<2>	0.000	310.15	
			1Floor_Conn	Main/<1>	0.000	420.92	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-420.92	
			1Floor_Conn	LightWell/<0>	0.000	449.64	

```
                  1Floor_Conn  VentStack_W/<1>    -0.000    -424.37
                  1Floor_Conn  LightWell/<0>     0.000     449.64
                  1Floor_Conn  LightWell/<0>     0.000     449.64
                  1Floor_Conn  VentStack_E/<1>    -0.000    -424.37
                  1Floor_Conn  LightWell/<0>     0.000     449.64
                  1Floor_Conn  VentStack_S/<1>    -0.000    -528.91

VentStack_W   -0.006   68.0  VentOutlet     Ambt      -0.001   -1274.75       1.63
                  3Floor_Conn  Main/<3>     0.000     536.05
                  2Floor_Conn  Main/<2>     0.000     312.70
                  1Floor_Conn  Main/<1>     0.000     424.37

VentStack_E   -0.006   68.0  VentOutlet     Ambt      -0.001   -1274.75       1.63
                  3Floor_Conn  Main/<3>     0.000     536.05
                  2Floor_Conn  Main/<2>     0.000     312.70
                  1Floor_Conn  Main/<1>     0.000     424.37

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      -0.001   -1586.74
                  3Floor_Conn  Main/<3>     0.000     668.10
                  2Floor_Conn  Main/<2>     0.000     389.73
                  1Floor_Conn  Main/<1>     0.000     528.91

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -310.15
                  2Floor_Conn  LightWell/<0>     0.000     331.32
                  2Floor_Conn  VentStack_W/<1>    -0.000    -312.70
                  2Floor_Conn  LightWell/<0>     0.000     331.32
                  2Floor_Conn  LightWell/<0>     0.000     331.32
                  2Floor_Conn  VentStack_E/<1>    -0.000    -312.70
                  2Floor_Conn  LightWell/<0>     0.000     331.32
                  2Floor_Conn  VentStack_S/<1>    -0.000    -389.73

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -531.68
                  3Floor_Conn  LightWell/<0>     0.000     567.97
                  3Floor_Conn  VentStack_W/<1>    -0.000    -536.05
                  3Floor_Conn  LightWell/<0>     0.000     567.97
                  3Floor_Conn  LightWell/<0>     0.000     567.97
                  3Floor_Conn  VentStack_E/<1>    -0.000    -536.05
                  3Floor_Conn  LightWell/<0>     0.000     567.97
                  3Floor_Conn  VentStack_S/<1>    -0.000    -668.10
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET2 **TUE FEB 09 11:27:59 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 2.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-378.46	
			3Floor_Conn	Main/<3>	-0.000	-378.46	
			3Floor_Conn	Main/<3>	-0.000	-378.46	
			3Floor_Conn	Main/<3>	-0.000	-378.46	
			2Floor_Conn	Main/<2>	-0.000	-220.77	
			2Floor_Conn	Main/<2>	-0.000	-220.77	
			2Floor_Conn	Main/<2>	-0.000	-220.77	
			2Floor_Conn	Main/<2>	-0.000	-220.77	
			1Floor_Conn	Main/<1>	-0.000	-299.61	
			1Floor_Conn	Main/<1>	-0.000	-299.61	
			1Floor_Conn	Main/<1>	-0.000	-299.61	
			1Floor_Conn	Main/<1>	-0.000	-299.61	
			Filter	Ambt	0.007	450.88	
			Filter	Ambt	0.007	450.88	
			Filter	Ambt	0.007	449.45	
			Filter	Ambt	0.007	449.45	
			Closed	Ambt	0.006	0.21	
			Filter	Ambt	0.007	449.45	
			Filter	Ambt	0.007	449.45	
			Filter	Ambt	0.007	447.80	
			Filter	Ambt	0.007	447.80	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1117.23	38.13
			3Floor_Conn	Main/<3>	0.000	454.36	
			2Floor_Conn	Main/<2>	0.000	265.04	
			1Floor_Conn	Main/<1>	0.000	359.70	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-359.70	

```
                1Floor_Conn  LightWell/<0>    0.000    299.61
                1Floor_Conn  VentStack_W/<1>   -0.000   -419.38
                1Floor_Conn  LightWell/<0>    0.000    299.61
                1Floor_Conn  LightWell/<0>    0.000    299.61
                1Floor_Conn  VentStack_E/<1>   -0.000   -419.38
                1Floor_Conn  LightWell/<0>    0.000    299.61
                1Floor_Conn  VentStack_S/<1>    0.000      0.00

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1261.43      3.29
                3Floor_Conn  Main/<3>    0.000    529.74
                2Floor_Conn  Main/<2>    0.000    309.02
                1Floor_Conn  Main/<1>    0.000    419.38

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1261.43      3.29
                3Floor_Conn  Main/<3>    0.000    529.74
                2Floor_Conn  Main/<2>    0.000    309.02
                1Floor_Conn  Main/<1>    0.000    419.38

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      0.000      0.01
                3Floor_Conn  Main/<3>   -0.000     -0.01
                2Floor_Conn  Main/<2>   -0.000     -0.00
                1Floor_Conn  Main/<1>   -0.000     -0.00

level: <2>    elevation: 13.1 ft

zone     P     T     path      from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -265.04
                2Floor_Conn  LightWell/<0>    0.000    220.77
                2Floor_Conn  VentStack_W/<1>   -0.000   -309.02
                2Floor_Conn  LightWell/<0>    0.000    220.77
                2Floor_Conn  LightWell/<0>    0.000    220.77
                2Floor_Conn  VentStack_E/<1>   -0.000   -309.02
                2Floor_Conn  LightWell/<0>    0.000    220.77
                2Floor_Conn  VentStack_S/<1>    0.000      0.00

level: <3>    elevation: 23.0 ft

zone     P     T     path      from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -454.36
                3Floor_Conn  LightWell/<0>    0.000    378.46
                3Floor_Conn  VentStack_W/<1>   -0.000   -529.74
                3Floor_Conn  LightWell/<0>    0.000    378.46
                3Floor_Conn  LightWell/<0>    0.000    378.46
                3Floor_Conn  VentStack_E/<1>   -0.000   -529.74
                3Floor_Conn  LightWell/<0>    0.000    378.46
                3Floor_Conn  VentStack_S/<1>    0.000      0.01
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET2+FAN.5** **TUE FEB 09 11:50:19 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 2.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-423.26	
			3Floor_Conn	Main/<3>	-0.000	-423.26	
			3Floor_Conn	Main/<3>	-0.000	-423.26	
			3Floor_Conn	Main/<3>	-0.000	-423.26	
			2Floor_Conn	Main/<2>	-0.000	-246.90	
			2Floor_Conn	Main/<2>	-0.000	-246.90	
			2Floor_Conn	Main/<2>	-0.000	-246.90	
			2Floor_Conn	Main/<2>	-0.000	-246.90	
			1Floor_Conn	Main/<1>	-0.000	-335.08	
			1Floor_Conn	Main/<1>	-0.000	-335.08	
			1Floor_Conn	Main/<1>	-0.000	-335.08	
			1Floor_Conn	Main/<1>	-0.000	-335.08	
			Filter	Ambt	0.007	440.79	
			Filter	Ambt	0.007	440.79	
			Filter	Ambt	0.007	439.36	
			Filter	Ambt	0.007	439.36	
			Fan.5	Ambt	0.006	506.56	
			Filter	Ambt	0.007	439.36	
			Filter	Ambt	0.007	439.36	
			Filter	Ambt	0.007	437.71	
			Filter	Ambt	0.007	437.71	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1224.47	9.59
			3Floor_Conn	Main/<3>	0.000	511.53	
			2Floor_Conn	Main/<2>	0.000	298.39	
			1Floor_Conn	Main/<1>	0.000	404.96	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-404.96	

```
                1Floor_Conn  LightWell/<0>    0.000    335.08
                1Floor_Conn  VentStack_W/<1>   -0.000   -454.93
                1Floor_Conn  LightWell/<0>    0.000    335.08
                1Floor_Conn  LightWell/<0>    0.000    335.08
                1Floor_Conn  VentStack_E/<1>   -0.000   -454.93
                1Floor_Conn  LightWell/<0>    0.000    335.08
                1Floor_Conn  VentStack_S/<1>   -0.000    -25.52

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1364.78
                3Floor_Conn  Main/<3>    0.000    574.64
                2Floor_Conn  Main/<2>    0.000    335.21
                1Floor_Conn  Main/<1>    0.000    454.93

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1364.78
                3Floor_Conn  Main/<3>    0.000    574.64
                2Floor_Conn  Main/<2>    0.000    335.21
                1Floor_Conn  Main/<1>    0.000    454.93

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000    -76.56
                3Floor_Conn  Main/<3>    0.000     32.23
                2Floor_Conn  Main/<2>    0.000     18.80
                1Floor_Conn  Main/<1>    0.000     25.52

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -298.39
                2Floor_Conn  LightWell/<0>    0.000    246.90
                2Floor_Conn  VentStack_W/<1>   -0.000   -335.21
                2Floor_Conn  LightWell/<0>    0.000    246.90
                2Floor_Conn  LightWell/<0>    0.000    246.90
                2Floor_Conn  VentStack_E/<1>   -0.000   -335.21
                2Floor_Conn  LightWell/<0>    0.000    246.90
                2Floor_Conn  VentStack_S/<1>   -0.000    -18.80

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -511.53
                3Floor_Conn  LightWell/<0>    0.000    423.26
                3Floor_Conn  VentStack_W/<1>   -0.000   -574.64
                3Floor_Conn  LightWell/<0>    0.000    423.26
                3Floor_Conn  LightWell/<0>    0.000    423.26
                3Floor_Conn  VentStack_E/<1>   -0.000   -574.64
                3Floor_Conn  LightWell/<0>    0.000    423.26
                3Floor_Conn  VentStack_S/<1>   -0.000    -32.23
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET2+FAN1** **TUE FEB 09 11:48:46 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 2.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-470.73	
			3Floor_Conn	Main/<3>	-0.000	-470.73	
			3Floor_Conn	Main/<3>	-0.000	-470.73	
			3Floor_Conn	Main/<3>	-0.000	-470.73	
			2Floor_Conn	Main/<2>	-0.000	-274.59	
			2Floor_Conn	Main/<2>	-0.000	-274.59	
			2Floor_Conn	Main/<2>	-0.000	-274.59	
			2Floor_Conn	Main/<2>	-0.000	-274.59	
			1Floor_Conn	Main/<1>	-0.000	-372.66	
			1Floor_Conn	Main/<1>	-0.000	-372.66	
			1Floor_Conn	Main/<1>	-0.000	-372.66	
			1Floor_Conn	Main/<1>	-0.000	-372.66	
			Filter	Ambt	0.007	433.85	
			Filter	Ambt	0.007	433.85	
			Filter	Ambt	0.007	432.41	
			Filter	Ambt	0.007	432.41	
			Fan1	Ambt	0.006	1013.11	
			Filter	Ambt	0.007	432.41	
			Filter	Ambt	0.007	432.41	
			Filter	Ambt	0.007	430.77	
			Filter	Ambt	0.007	430.77	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1294.86	0.06
			3Floor_Conn	Main/<3>	0.000	545.18	
			2Floor_Conn	Main/<2>	0.000	318.02	
			1Floor_Conn	Main/<1>	0.000	431.60	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-431.60	

```
                1Floor_Conn  LightWell/<0>    0.000    372.66
                1Floor_Conn  VentStack_W/<1>   -0.000   -474.24
                1Floor_Conn  LightWell/<0>    0.000    372.66
                1Floor_Conn  LightWell/<0>    0.000    372.66
                1Floor_Conn  VentStack_E/<1>   -0.000   -474.24
                1Floor_Conn  LightWell/<0>    0.000    372.66
                1Floor_Conn  VentStack_S/<1>   -0.000   -110.57

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1422.72
                3Floor_Conn  Main/<3>    0.000    599.04
                2Floor_Conn  Main/<2>    0.000    349.44
                1Floor_Conn  Main/<1>    0.000    474.24

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1422.72
                3Floor_Conn  Main/<3>    0.000    599.04
                2Floor_Conn  Main/<2>    0.000    349.44
                1Floor_Conn  Main/<1>    0.000    474.24

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000    -331.72
                3Floor_Conn  Main/<3>    0.000    139.67
                2Floor_Conn  Main/<2>    0.000     81.48
                1Floor_Conn  Main/<1>    0.000    110.57

level: <2>    elevation: 13.1 ft

zone     P      T      path       from        dP      Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -318.02
                2Floor_Conn  LightWell/<0>    0.000    274.59
                2Floor_Conn  VentStack_W/<1>   -0.000   -349.44
                2Floor_Conn  LightWell/<0>    0.000    274.59
                2Floor_Conn  LightWell/<0>    0.000    274.59
                2Floor_Conn  VentStack_E/<1>   -0.000   -349.44
                2Floor_Conn  LightWell/<0>    0.000    274.59
                2Floor_Conn  VentStack_S/<1>   -0.000    -81.48

level: <3>    elevation: 23.0 ft

zone     P      T      path       from        dP      Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -545.18
                3Floor_Conn  LightWell/<0>    0.000    470.73
                3Floor_Conn  VentStack_W/<1>   -0.000   -599.04
                3Floor_Conn  LightWell/<0>    0.000    470.73
                3Floor_Conn  LightWell/<0>    0.000    470.73
                3Floor_Conn  VentStack_E/<1>   -0.000   -599.04
                3Floor_Conn  LightWell/<0>    0.000    470.73
                3Floor_Conn  VentStack_S/<1>   -0.000   -139.67
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °
* indicates limit exceeded

PROJECT**: FILTERINLET2+FAN1.5** **TUE FEB 09 11:51:34 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 2.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.006	68.0	3Floor_Conn	Main/<3>	-0.000	-516.81	
			3Floor_Conn	Main/<3>	-0.000	-516.81	
			3Floor_Conn	Main/<3>	-0.000	-516.81	
			3Floor_Conn	Main/<3>	-0.000	-516.81	
			2Floor_Conn	Main/<2>	-0.000	-301.47	
			2Floor_Conn	Main/<2>	-0.000	-301.47	
			2Floor_Conn	Main/<2>	-0.000	-301.47	
			2Floor_Conn	Main/<2>	-0.000	-301.47	
			1Floor_Conn	Main/<1>	-0.000	-409.14	
			1Floor_Conn	Main/<1>	-0.000	-409.14	
			1Floor_Conn	Main/<1>	-0.000	-409.14	
			1Floor_Conn	Main/<1>	-0.000	-409.14	
			Filter	Ambt	0.006	425.24	
			Filter	Ambt	0.006	425.24	
			Filter	Ambt	0.006	423.80	
			Filter	Ambt	0.006	423.80	
			Fan1.5	Ambt	0.006	1519.66	
			Filter	Ambt	0.006	423.80	
			Filter	Ambt	0.006	423.80	
			Filter	Ambt	0.006	422.16	
			Filter	Ambt	0.006	422.16	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1375.54	
			3Floor_Conn	Main/<3>	0.000	579.17	
			2Floor_Conn	Main/<2>	0.000	337.85	
			1Floor_Conn	Main/<1>	0.000	458.51	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-458.51	

```
                    1Floor_Conn  LightWell/<0>    0.000    409.14
                    1Floor_Conn  VentStack_W/<1>   -0.000   -497.07
                    1Floor_Conn  LightWell/<0>    0.000    409.14
                    1Floor_Conn  LightWell/<0>    0.000    409.14
                    1Floor_Conn  VentStack_E/<1>   -0.000   -497.07
                    1Floor_Conn  LightWell/<0>    0.000    409.14
                    1Floor_Conn  VentStack_S/<1>   -0.000   -183.91

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1491.20
                    3Floor_Conn  Main/<3>    0.000    627.87
                    2Floor_Conn  Main/<2>    0.000    366.26
                    1Floor_Conn  Main/<1>    0.000    497.07

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1491.20
                    3Floor_Conn  Main/<3>    0.000    627.87
                    2Floor_Conn  Main/<2>    0.000    366.26
                    1Floor_Conn  Main/<1>    0.000    497.07

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     -0.000    -551.72
                    3Floor_Conn  Main/<3>    0.000    232.30
                    2Floor_Conn  Main/<2>    0.000    135.51
                    1Floor_Conn  Main/<1>    0.000    183.91

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -337.85
                    2Floor_Conn  LightWell/<0>    0.000    301.47
                    2Floor_Conn  VentStack_W/<1>   -0.000   -366.26
                    2Floor_Conn  LightWell/<0>    0.000    301.47
                    2Floor_Conn  LightWell/<0>    0.000    301.47
                    2Floor_Conn  VentStack_E/<1>   -0.000   -366.26
                    2Floor_Conn  LightWell/<0>    0.000    301.47
                    2Floor_Conn  VentStack_S/<1>   -0.000   -135.51

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -579.17
                    3Floor_Conn  LightWell/<0>    0.000    516.81
                    3Floor_Conn  VentStack_W/<1>   -0.000   -627.87
                    3Floor_Conn  LightWell/<0>    0.000    516.81
                    3Floor_Conn  LightWell/<0>    0.000    516.81
                    3Floor_Conn  VentStack_E/<1>   -0.000   -627.87
                    3Floor_Conn  LightWell/<0>    0.000    516.81
                    3Floor_Conn  VentStack_S/<1>   -0.000   -232.30
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H_2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET2+FAN2** **TUE FEB 09 11:52:46 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 2.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.006	68.0	3Floor_Conn	Main/<3>	-0.000	-562.00	
			3Floor_Conn	Main/<3>	-0.000	-562.00	
			3Floor_Conn	Main/<3>	-0.000	-562.00	
			3Floor_Conn	Main/<3>	-0.000	-562.00	
			2Floor_Conn	Main/<2>	-0.000	-327.83	
			2Floor_Conn	Main/<2>	-0.000	-327.83	
			2Floor_Conn	Main/<2>	-0.000	-327.83	
			2Floor_Conn	Main/<2>	-0.000	-327.83	
			1Floor_Conn	Main/<1>	-0.000	-444.92	
			1Floor_Conn	Main/<1>	-0.000	-444.92	
			1Floor_Conn	Main/<1>	-0.000	-444.92	
			1Floor_Conn	Main/<1>	-0.000	-444.92	
			Filter	Ambt	0.006	415.59	
			Filter	Ambt	0.006	415.59	
			Filter	Ambt	0.006	414.15	
			Filter	Ambt	0.006	414.15	
			Fan2	Ambt	0.006	2026.22	
			Filter	Ambt	0.006	414.15	
			Filter	Ambt	0.006	414.15	
			Filter	Ambt	0.006	412.51	
			Filter	Ambt	0.006	412.51	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1456.34	
			3Floor_Conn	Main/<3>	0.000	613.20	
			2Floor_Conn	Main/<2>	0.000	357.70	
			1Floor_Conn	Main/<1>	0.000	485.45	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-485.45	

```
                   1Floor_Conn  LightWell/<0>     0.000     444.92
                   1Floor_Conn  VentStack_W/<1>    -0.000    -521.19
                   1Floor_Conn  LightWell/<0>     0.000     444.92
                   1Floor_Conn  LightWell/<0>     0.000     444.92
                   1Floor_Conn  VentStack_E/<1>    -0.000    -521.19
                   1Floor_Conn  LightWell/<0>     0.000     444.92
                   1Floor_Conn  VentStack_S/<1>    -0.000    -251.84

VentStack_W   -0.006   68.0  VentOutlet     Ambt      -0.001   -1563.56
                   3Floor_Conn  Main/<3>    0.000     658.34
                   2Floor_Conn  Main/<2>    0.000     384.03
                   1Floor_Conn  Main/<1>    0.000     521.19

VentStack_E   -0.006   68.0  VentOutlet     Ambt      -0.001   -1563.56
                   3Floor_Conn  Main/<3>    0.000     658.34
                   2Floor_Conn  Main/<2>    0.000     384.03
                   1Floor_Conn  Main/<1>    0.000     521.19

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      -0.000    -755.54
                   3Floor_Conn  Main/<3>    0.000     318.12
                   2Floor_Conn  Main/<2>    0.000     185.57
                   1Floor_Conn  Main/<1>    0.000     251.84

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -357.70
                   2Floor_Conn  LightWell/<0>     0.000     327.83
                   2Floor_Conn  VentStack_W/<1>    -0.000    -384.03
                   2Floor_Conn  LightWell/<0>     0.000     327.83
                   2Floor_Conn  LightWell/<0>     0.000     327.83
                   2Floor_Conn  VentStack_E/<1>    -0.000    -384.03
                   2Floor_Conn  LightWell/<0>     0.000     327.83
                   2Floor_Conn  VentStack_S/<1>    -0.000    -185.57

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -613.20
                   3Floor_Conn  LightWell/<0>     0.000     562.00
                   3Floor_Conn  VentStack_W/<1>    -0.000    -658.34
                   3Floor_Conn  LightWell/<0>     0.000     562.00
                   3Floor_Conn  LightWell/<0>     0.000     562.00
                   3Floor_Conn  VentStack_E/<1>    -0.000    -658.34
                   3Floor_Conn  LightWell/<0>     0.000     562.00
                   3Floor_Conn  VentStack_S/<1>    -0.000    -318.12
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H_2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET4** **FRI FEB 05 10:55:18 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 4.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-416.73	
			3Floor_Conn	Main/<3>	-0.000	-416.73	
			3Floor_Conn	Main/<3>	-0.000	-416.73	
			3Floor_Conn	Main/<3>	-0.000	-416.73	
			2Floor_Conn	Main/<2>	-0.000	-243.09	
			2Floor_Conn	Main/<2>	-0.000	-243.09	
			2Floor_Conn	Main/<2>	-0.000	-243.09	
			2Floor_Conn	Main/<2>	-0.000	-243.09	
			1Floor_Conn	Main/<1>	-0.000	-329.91	
			1Floor_Conn	Main/<1>	-0.000	-329.91	
			1Floor_Conn	Main/<1>	-0.000	-329.91	
			1Floor_Conn	Main/<1>	-0.000	-329.91	
			Filter	Ambt	0.007	500.79	
			Filter	Ambt	0.007	500.79	
			Filter	Ambt	0.007	495.05	
			Filter	Ambt	0.007	495.05	
			Closed	Ambt	0.007	0.21	
			Filter	Ambt	0.007	495.05	
			Filter	Ambt	0.007	495.05	
			Filter	Ambt	0.007	488.48	
			Filter	Ambt	0.007	488.48	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.000	-996.08	84.77
			3Floor_Conn	Main/<3>	0.000	383.71	
			2Floor_Conn	Main/<2>	0.000	223.83	
			1Floor_Conn	Main/<1>	0.000	303.77	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-303.77	

```
                 1Floor_Conn  LightWell/<0>    0.000    329.91
                 1Floor_Conn  VentStack_W/<1>   -0.000   -507.96
                 1Floor_Conn  LightWell/<0>    0.000    329.91
                 1Floor_Conn  LightWell/<0>    0.000    329.91
                 1Floor_Conn  VentStack_E/<1>   -0.000   -507.96
                 1Floor_Conn  LightWell/<0>    0.000    329.91
                 1Floor_Conn  VentStack_S/<1>    0.000      0.05

VentStack_W   -0.007   68.0  VentOutlet    Ambt     -0.001   -1523.88
                 3Floor_Conn  Main/<3>    0.000    641.63
                 2Floor_Conn  Main/<2>    0.000    374.29
                 1Floor_Conn  Main/<1>    0.000    507.96

VentStack_E   -0.007   68.0  VentOutlet    Ambt     -0.001   -1523.88
                 3Floor_Conn  Main/<3>    0.000    641.63
                 2Floor_Conn  Main/<2>    0.000    374.29
                 1Floor_Conn  Main/<1>    0.000    507.96

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     0.002      0.14
                 3Floor_Conn  Main/<3>   -0.000     -0.06
                 2Floor_Conn  Main/<2>   -0.000     -0.03
                 1Floor_Conn  Main/<1>   -0.000     -0.05

level: <2>    elevation: 13.1 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -223.83
                 2Floor_Conn  LightWell/<0>    0.000    243.09
                 2Floor_Conn  VentStack_W/<1>   -0.000   -374.29
                 2Floor_Conn  LightWell/<0>    0.000    243.09
                 2Floor_Conn  LightWell/<0>    0.000    243.09
                 2Floor_Conn  VentStack_E/<1>   -0.000   -374.29
                 2Floor_Conn  LightWell/<0>    0.000    243.09
                 2Floor_Conn  VentStack_S/<1>    0.000      0.03

level: <3>    elevation: 23.0 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -383.71
                 3Floor_Conn  LightWell/<0>    0.000    416.73
                 3Floor_Conn  VentStack_W/<1>   -0.000   -641.63
                 3Floor_Conn  LightWell/<0>    0.000    416.73
                 3Floor_Conn  LightWell/<0>    0.000    416.73
                 3Floor_Conn  VentStack_E/<1>   -0.000   -641.63
                 3Floor_Conn  LightWell/<0>    0.000    416.73
                 3Floor_Conn  VentStack_S/<1>    0.000      0.06
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET4+FAN.5** **FRI FEB 05 10:57:17 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 4.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-458.80	
			3Floor_Conn	Main/<3>	-0.000	-458.80	
			3Floor_Conn	Main/<3>	-0.000	-458.80	
			3Floor_Conn	Main/<3>	-0.000	-458.80	
			2Floor_Conn	Main/<2>	-0.000	-267.63	
			2Floor_Conn	Main/<2>	-0.000	-267.63	
			2Floor_Conn	Main/<2>	-0.000	-267.63	
			2Floor_Conn	Main/<2>	-0.000	-267.63	
			1Floor_Conn	Main/<1>	-0.000	-363.22	
			1Floor_Conn	Main/<1>	-0.000	-363.22	
			1Floor_Conn	Main/<1>	-0.000	-363.22	
			1Floor_Conn	Main/<1>	-0.000	-363.22	
			Filter	Ambt	0.007	487.46	
			Filter	Ambt	0.007	487.46	
			Filter	Ambt	0.007	481.71	
			Filter	Ambt	0.007	481.71	
			Fan.5	Ambt	0.007	506.56	
			Filter	Ambt	0.007	481.71	
			Filter	Ambt	0.007	481.71	
			Filter	Ambt	0.007	475.14	
			Filter	Ambt	0.007	475.14	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1137.99	31.59
			3Floor_Conn	Main/<3>	0.000	465.85	
			2Floor_Conn	Main/<2>	0.000	271.75	
			1Floor_Conn	Main/<1>	0.000	368.80	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-368.80	

```
                  1Floor_Conn  LightWell/<0>     0.000     363.22
                  1Floor_Conn  VentStack_W/<1>   -0.000    -542.06
                  1Floor_Conn  LightWell/<0>     0.000     363.22
                  1Floor_Conn  LightWell/<0>     0.000     363.22
                  1Floor_Conn  VentStack_E/<1>   -0.000    -542.06
                  1Floor_Conn  LightWell/<0>     0.000     363.22
                  1Floor_Conn  VentStack_S/<1>    0.000       0.04

VentStack_W   -0.006   68.0  VentOutlet     Ambt     -0.001   -1626.17
                  3Floor_Conn  Main/<3>     0.000     684.70
                  2Floor_Conn  Main/<2>     0.000     399.41
                  1Floor_Conn  Main/<1>     0.000     542.06

VentStack_E   -0.006   68.0  VentOutlet     Ambt     -0.001   -1626.17
                  3Floor_Conn  Main/<3>     0.000     684.70
                  2Floor_Conn  Main/<2>     0.000     399.41
                  1Floor_Conn  Main/<1>     0.000     542.06

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      0.002       0.13
                  3Floor_Conn  Main/<3>    -0.000      -0.06
                  2Floor_Conn  Main/<2>    -0.000      -0.03
                  1Floor_Conn  Main/<1>    -0.000      -0.04

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -271.75
                  2Floor_Conn  LightWell/<0>     0.000     267.63
                  2Floor_Conn  VentStack_W/<1>   -0.000    -399.41
                  2Floor_Conn  LightWell/<0>     0.000     267.63
                  2Floor_Conn  LightWell/<0>     0.000     267.63
                  2Floor_Conn  VentStack_E/<1>   -0.000    -399.41
                  2Floor_Conn  LightWell/<0>     0.000     267.63
                  2Floor_Conn  VentStack_S/<1>    0.000       0.03

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -465.85
                  3Floor_Conn  LightWell/<0>     0.000     458.80
                  3Floor_Conn  VentStack_W/<1>   -0.000    -684.70
                  3Floor_Conn  LightWell/<0>     0.000     458.80
                  3Floor_Conn  LightWell/<0>     0.000     458.80
                  3Floor_Conn  VentStack_E/<1>   -0.000    -684.70
                  3Floor_Conn  LightWell/<0>     0.000     458.80
                  3Floor_Conn  VentStack_S/<1>    0.000       0.06
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET4+FAN1** **FRI FEB 05 10:58:35 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 4.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-500.07	
			3Floor_Conn	Main/<3>	-0.000	-500.07	
			3Floor_Conn	Main/<3>	-0.000	-500.07	
			3Floor_Conn	Main/<3>	-0.000	-500.07	
			2Floor_Conn	Main/<2>	-0.000	-291.71	
			2Floor_Conn	Main/<2>	-0.000	-291.71	
			2Floor_Conn	Main/<2>	-0.000	-291.71	
			2Floor_Conn	Main/<2>	-0.000	-291.71	
			1Floor_Conn	Main/<1>	-0.000	-395.89	
			1Floor_Conn	Main/<1>	-0.000	-395.89	
			1Floor_Conn	Main/<1>	-0.000	-395.89	
			1Floor_Conn	Main/<1>	-0.000	-395.89	
			Filter	Ambt	0.007	473.15	
			Filter	Ambt	0.007	473.15	
			Filter	Ambt	0.007	467.40	
			Filter	Ambt	0.007	467.40	
			Fan1	Ambt	0.006	1013.11	
			Filter	Ambt	0.007	467.40	
			Filter	Ambt	0.007	467.40	
			Filter	Ambt	0.007	460.83	
			Filter	Ambt	0.007	460.83	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1295.20	0.05
			3Floor_Conn	Main/<3>	0.000	545.33	
			2Floor_Conn	Main/<2>	0.000	318.11	
			1Floor_Conn	Main/<1>	0.000	431.72	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-431.72	

```
                1Floor_Conn  LightWell/<0>    0.000    395.89
                1Floor_Conn  VentStack_W/<1>   -0.000   -575.94
                1Floor_Conn  LightWell/<0>    0.000    395.89
                1Floor_Conn  LightWell/<0>    0.000    395.89
                1Floor_Conn  VentStack_E/<1>   -0.000   -575.94
                1Floor_Conn  LightWell/<0>    0.000    395.89
                1Floor_Conn  VentStack_S/<1>    0.000      0.04

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1727.83
                3Floor_Conn  Main/<3>    0.000    727.51
                2Floor_Conn  Main/<2>    0.000    424.38
                1Floor_Conn  Main/<1>    0.000    575.94

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1727.83
                3Floor_Conn  Main/<3>    0.000    727.51
                2Floor_Conn  Main/<2>    0.000    424.38
                1Floor_Conn  Main/<1>    0.000    575.94

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt     0.002      0.13
                3Floor_Conn  Main/<3>   -0.000     -0.05
                2Floor_Conn  Main/<2>   -0.000     -0.03
                1Floor_Conn  Main/<1>   -0.000     -0.04

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -318.11
                2Floor_Conn  LightWell/<0>    0.000    291.71
                2Floor_Conn  VentStack_W/<1>   -0.000   -424.38
                2Floor_Conn  LightWell/<0>    0.000    291.71
                2Floor_Conn  LightWell/<0>    0.000    291.71
                2Floor_Conn  VentStack_E/<1>   -0.000   -424.38
                2Floor_Conn  LightWell/<0>    0.000    291.71
                2Floor_Conn  VentStack_S/<1>    0.000      0.03

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -545.33
                3Floor_Conn  LightWell/<0>    0.000    500.07
                3Floor_Conn  VentStack_W/<1>   -0.000   -727.51
                3Floor_Conn  LightWell/<0>    0.000    500.07
                3Floor_Conn  LightWell/<0>    0.000    500.07
                3Floor_Conn  VentStack_E/<1>   -0.000   -727.51
                3Floor_Conn  LightWell/<0>    0.000    500.07
                3Floor_Conn  VentStack_S/<1>    0.000      0.05
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET4+FAN1.5** **FRI FEB 05 11:00:03 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 4.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-539.57	
			3Floor_Conn	Main/<3>	-0.000	-539.57	
			3Floor_Conn	Main/<3>	-0.000	-539.57	
			3Floor_Conn	Main/<3>	-0.000	-539.57	
			2Floor_Conn	Main/<2>	-0.000	-314.75	
			2Floor_Conn	Main/<2>	-0.000	-314.75	
			2Floor_Conn	Main/<2>	-0.000	-314.75	
			2Floor_Conn	Main/<2>	-0.000	-314.75	
			1Floor_Conn	Main/<1>	-0.000	-427.16	
			1Floor_Conn	Main/<1>	-0.000	-427.16	
			1Floor_Conn	Main/<1>	-0.000	-427.16	
			1Floor_Conn	Main/<1>	-0.000	-427.16	
			Filter	Ambt	0.007	456.74	
			Filter	Ambt	0.007	456.74	
			Filter	Ambt	0.007	450.99	
			Filter	Ambt	0.007	450.99	
			Fan1.5	Ambt	0.006	1519.66	
			Filter	Ambt	0.007	450.99	
			Filter	Ambt	0.007	450.99	
			Filter	Ambt	0.007	444.42	
			Filter	Ambt	0.007	444.42	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1451.69	
			3Floor_Conn	Main/<3>	0.000	611.24	
			2Floor_Conn	Main/<2>	0.000	356.56	
			1Floor_Conn	Main/<1>	0.000	483.90	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-483.90	

```
                 1Floor_Conn  LightWell/<0>     0.000     427.16
                 1Floor_Conn  VentStack_W/<1>   -0.000    -612.40
                 1Floor_Conn  LightWell/<0>     0.000     427.16
                 1Floor_Conn  LightWell/<0>     0.000     427.16
                 1Floor_Conn  VentStack_E/<1>   -0.000    -612.40
                 1Floor_Conn  LightWell/<0>     0.000     427.16
                 1Floor_Conn  VentStack_S/<1>    0.000      0.04

VentStack_W   -0.006   68.0  VentOutlet    Ambt     -0.001   -1837.19
                 3Floor_Conn  Main/<3>    0.000    773.55
                 2Floor_Conn  Main/<2>    0.000    451.24
                 1Floor_Conn  Main/<1>    0.000    612.40

VentStack_E   -0.006   68.0  VentOutlet    Ambt     -0.001   -1837.19
                 3Floor_Conn  Main/<3>    0.000    773.55
                 2Floor_Conn  Main/<2>    0.000    451.24
                 1Floor_Conn  Main/<1>    0.000    612.40

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      0.002      0.12
                 3Floor_Conn  Main/<3>   -0.000     -0.05
                 2Floor_Conn  Main/<2>   -0.000     -0.03
                 1Floor_Conn  Main/<1>   -0.000     -0.04

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -356.56
                 2Floor_Conn  LightWell/<0>     0.000     314.75
                 2Floor_Conn  VentStack_W/<1>   -0.000    -451.24
                 2Floor_Conn  LightWell/<0>     0.000     314.75
                 2Floor_Conn  LightWell/<0>     0.000     314.75
                 2Floor_Conn  VentStack_E/<1>   -0.000    -451.24
                 2Floor_Conn  LightWell/<0>     0.000     314.75
                 2Floor_Conn  VentStack_S/<1>    0.000      0.03

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -611.24
                 3Floor_Conn  LightWell/<0>     0.000     539.57
                 3Floor_Conn  VentStack_W/<1>   -0.000    -773.55
                 3Floor_Conn  LightWell/<0>     0.000     539.57
                 3Floor_Conn  LightWell/<0>     0.000     539.57
                 3Floor_Conn  VentStack_E/<1>   -0.000    -773.55
                 3Floor_Conn  LightWell/<0>     0.000     539.57
                 3Floor_Conn  VentStack_S/<1>    0.000      0.05
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET4+FAN2** **FRI FEB 05 11:01:20 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 4.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.006	68.0	3Floor_Conn	Main/<3>	-0.000	-577.97	
			3Floor_Conn	Main/<3>	-0.000	-577.97	
			3Floor_Conn	Main/<3>	-0.000	-577.97	
			3Floor_Conn	Main/<3>	-0.000	-577.97	
			2Floor_Conn	Main/<2>	-0.000	-337.15	
			2Floor_Conn	Main/<2>	-0.000	-337.15	
			2Floor_Conn	Main/<2>	-0.000	-337.15	
			2Floor_Conn	Main/<2>	-0.000	-337.15	
			1Floor_Conn	Main/<1>	-0.000	-457.56	
			1Floor_Conn	Main/<1>	-0.000	-457.56	
			1Floor_Conn	Main/<1>	-0.000	-457.56	
			1Floor_Conn	Main/<1>	-0.000	-457.56	
			Filter	Ambt	0.007	439.02	
			Filter	Ambt	0.007	439.02	
			Filter	Ambt	0.007	433.27	
			Filter	Ambt	0.007	433.27	
			Fan2	Ambt	0.006	2026.22	
			Filter	Ambt	0.007	433.27	
			Filter	Ambt	0.007	433.27	
			Filter	Ambt	0.006	426.70	
			Filter	Ambt	0.006	426.70	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.006	68.0	VentOutlet	Ambt	-0.001	-1595.03	
			3Floor_Conn	Main/<3>	0.000	671.59	
			2Floor_Conn	Main/<2>	0.000	391.76	
			1Floor_Conn	Main/<1>	0.000	531.68	
Main	-0.006	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-531.68	

```
                 1Floor_Conn  LightWell/<0>     0.000     457.56
                 1Floor_Conn  VentStack_W/<1>   -0.000    -649.30
                 1Floor_Conn  LightWell/<0>     0.000     457.56
                 1Floor_Conn  LightWell/<0>     0.000     457.56
                 1Floor_Conn  VentStack_E/<1>   -0.000    -649.30
                 1Floor_Conn  LightWell/<0>     0.000     457.56
                 1Floor_Conn  VentStack_S/<1>    0.000      0.04

VentStack_W   -0.006   68.0  VentOutlet     Ambt     -0.001   -1947.91
                 3Floor_Conn  Main/<3>    0.000     820.17
                 2Floor_Conn  Main/<2>    0.000     478.44
                 1Floor_Conn  Main/<1>    0.000     649.30

VentStack_E   -0.006   68.0  VentOutlet     Ambt     -0.001   -1947.91
                 3Floor_Conn  Main/<3>    0.000     820.17
                 2Floor_Conn  Main/<2>    0.000     478.44
                 1Floor_Conn  Main/<1>    0.000     649.30

VentStack_S   -0.006   68.0  BackdraftRoof   Ambt      0.002      0.11
                 3Floor_Conn  Main/<3>   -0.000     -0.05
                 2Floor_Conn  Main/<2>   -0.000     -0.03
                 1Floor_Conn  Main/<1>   -0.000     -0.04

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.004   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -391.76
                 2Floor_Conn  LightWell/<0>     0.000     337.15
                 2Floor_Conn  VentStack_W/<1>   -0.000    -478.44
                 2Floor_Conn  LightWell/<0>     0.000     337.15
                 2Floor_Conn  LightWell/<0>     0.000     337.15
                 2Floor_Conn  VentStack_E/<1>   -0.000    -478.44
                 2Floor_Conn  LightWell/<0>     0.000     337.15
                 2Floor_Conn  VentStack_S/<1>    0.000      0.03

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.002   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -671.59
                 3Floor_Conn  LightWell/<0>     0.000     577.97
                 3Floor_Conn  VentStack_W/<1>   -0.000    -820.17
                 3Floor_Conn  LightWell/<0>     0.000     577.97
                 3Floor_Conn  LightWell/<0>     0.000     577.97
                 3Floor_Conn  VentStack_E/<1>   -0.000    -820.17
                 3Floor_Conn  LightWell/<0>     0.000     577.97
                 3Floor_Conn  VentStack_S/<1>    0.000      0.05
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET7.5** **MON JAN 18 13:22:00 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 7.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.008	68.0	3Floor_Conn	Main/<3>	-0.000	-531.03	
			3Floor_Conn	Main/<3>	-0.000	-531.03	
			3Floor_Conn	Main/<3>	-0.000	-531.03	
			3Floor_Conn	Main/<3>	-0.000	-531.03	
			2Floor_Conn	Main/<2>	-0.000	-309.77	
			2Floor_Conn	Main/<2>	-0.000	-309.77	
			2Floor_Conn	Main/<2>	-0.000	-309.77	
			2Floor_Conn	Main/<2>	-0.000	-309.77	
			1Floor_Conn	Main/<1>	-0.000	-420.40	
			1Floor_Conn	Main/<1>	-0.000	-420.40	
			1Floor_Conn	Main/<1>	-0.000	-420.40	
			1Floor_Conn	Main/<1>	-0.000	-420.40	
			Filter	Ambt	0.009	651.54	
			Filter	Ambt	0.009	651.54	
			Filter	Ambt	0.008	631.32	
			Filter	Ambt	0.008	631.32	
			Filter	Ambt	0.008	631.32	
			Filter	Ambt	0.008	631.32	
			Filter	Ambt	0.008	608.22	
			Filter	Ambt	0.008	608.22	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.008	68.0	VentOutlet	Ambt	-0.000	-784.69	198.50
			3Floor_Conn	Main/<3>	0.000	246.82	
			2Floor_Conn	Main/<2>	0.000	143.98	
			1Floor_Conn	Main/<1>	0.000	195.40	
Main	-0.008	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-195.40	
			1Floor_Conn	LightWell/<0>	0.000	420.40	

```
                1Floor_Conn  VentStack_W/<1>   -0.000   -743.16
                1Floor_Conn  LightWell/<0>    0.000    420.40
                1Floor_Conn  LightWell/<0>    0.000    420.40
                1Floor_Conn  VentStack_E/<1>   -0.000   -743.16
                1Floor_Conn  LightWell/<0>    0.000    420.40
                1Floor_Conn  VentStack_S/<1>    0.000      0.13

VentStack_W   -0.008   68.0  VentOutlet     Ambt     -0.002   -2229.49
                3Floor_Conn  Main/<3>    0.000    938.73
                2Floor_Conn  Main/<2>    0.000    547.60
                1Floor_Conn  Main/<1>    0.000    743.16

VentStack_E   -0.008   68.0  VentOutlet     Ambt     -0.002   -2229.49
                3Floor_Conn  Main/<3>    0.000    938.73
                2Floor_Conn  Main/<2>    0.000    547.60
                1Floor_Conn  Main/<1>    0.000    743.16

VentStack_S   -0.008   68.0  BackdraftRoof   Ambt      0.009      0.38
                3Floor_Conn  Main/<3>   -0.000     -0.16
                2Floor_Conn  Main/<2>   -0.000     -0.09
                1Floor_Conn  Main/<1>   -0.000     -0.13

level: <2>    elevation: 13.1 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.006   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -143.98
                2Floor_Conn  LightWell/<0>    0.000    309.77
                2Floor_Conn  VentStack_W/<1>   -0.000   -547.60
                2Floor_Conn  LightWell/<0>    0.000    309.77
                2Floor_Conn  LightWell/<0>    0.000    309.77
                2Floor_Conn  VentStack_E/<1>   -0.000   -547.60
                2Floor_Conn  LightWell/<0>    0.000    309.77
                2Floor_Conn  VentStack_S/<1>    0.000      0.09

level: <3>    elevation: 23.0 ft

zone     P      T      path       from        dP     Flow1     Flow2
Main   -0.004   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -246.82
                3Floor_Conn  LightWell/<0>    0.000    531.03
                3Floor_Conn  VentStack_W/<1>   -0.000   -938.73
                3Floor_Conn  LightWell/<0>    0.000    531.03
                3Floor_Conn  LightWell/<0>    0.000    531.03
                3Floor_Conn  VentStack_E/<1>   -0.000   -938.73
                3Floor_Conn  LightWell/<0>    0.000    531.03
                3Floor_Conn  VentStack_S/<1>    0.000      0.16
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET7.5+FAN1** **TUE JAN 19 14:34:24 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 7.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.008	68.0	3Floor_Conn	Main/<3>	-0.000	-612.11	
			3Floor_Conn	Main/<3>	-0.000	-612.11	
			3Floor_Conn	Main/<3>	-0.000	-612.11	
			3Floor_Conn	Main/<3>	-0.000	-612.11	
			2Floor_Conn	Main/<2>	-0.000	-357.06	
			2Floor_Conn	Main/<2>	-0.000	-357.06	
			2Floor_Conn	Main/<2>	-0.000	-357.06	
			2Floor_Conn	Main/<2>	-0.000	-357.06	
			1Floor_Conn	Main/<1>	-0.000	-484.58	
			1Floor_Conn	Main/<1>	-0.000	-484.58	
			1Floor_Conn	Main/<1>	-0.000	-484.58	
			1Floor_Conn	Main/<1>	-0.000	-484.58	
			Filter	Ambt	0.008	621.18	
			Filter	Ambt	0.008	621.18	
			Filter	Ambt	0.008	600.96	
			Filter	Ambt	0.008	600.96	
			Fan1	Ambt	0.007	1013.11	
			Filter	Ambt	0.008	600.96	
			Filter	Ambt	0.008	600.96	
			Filter	Ambt	0.008	577.86	
			Filter	Ambt	0.008	577.86	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.007	68.0	VentOutlet	Ambt	-0.001	-1098.47	44.42
			3Floor_Conn	Main/<3>	0.000	443.81	
			2Floor_Conn	Main/<2>	0.000	258.89	
			1Floor_Conn	Main/<1>	0.000	351.35	
Main	-0.007	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-351.35	

```
                1Floor_Conn  LightWell/<0>    0.000    484.58
                1Floor_Conn  VentStack_W/<1>   -0.000   -793.56
                1Floor_Conn  LightWell/<0>    0.000    484.58
                1Floor_Conn  LightWell/<0>    0.000    484.58
                1Floor_Conn  VentStack_E/<1>   -0.000   -793.56
                1Floor_Conn  LightWell/<0>    0.000    484.58
                1Floor_Conn  VentStack_S/<1>    0.000      0.12

VentStack_W   -0.007   68.0  VentOutlet    Ambt     -0.002   -2380.67
                3Floor_Conn  Main/<3>    0.000   1002.39
                2Floor_Conn  Main/<2>    0.000    584.73
                1Floor_Conn  Main/<1>    0.000    793.56

VentStack_E   -0.007   68.0  VentOutlet    Ambt     -0.002   -2380.67
                3Floor_Conn  Main/<3>    0.000   1002.39
                2Floor_Conn  Main/<2>    0.000    584.73
                1Floor_Conn  Main/<1>    0.000    793.56

VentStack_S   -0.007   68.0  BackdraftRoof   Ambt      0.009      0.37
                3Floor_Conn  Main/<3>   -0.000     -0.16
                2Floor_Conn  Main/<2>   -0.000     -0.09
                1Floor_Conn  Main/<1>   -0.000     -0.12

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.005   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -258.89
                2Floor_Conn  LightWell/<0>    0.000    357.06
                2Floor_Conn  VentStack_W/<1>   -0.000   -584.73
                2Floor_Conn  LightWell/<0>    0.000    357.06
                2Floor_Conn  LightWell/<0>    0.000    357.06
                2Floor_Conn  VentStack_E/<1>   -0.000   -584.73
                2Floor_Conn  LightWell/<0>    0.000    357.06
                2Floor_Conn  VentStack_S/<1>    0.000      0.09

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.003   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -443.81
                3Floor_Conn  LightWell/<0>    0.000    612.11
                3Floor_Conn  VentStack_W/<1>   -0.000   -1002.39
                3Floor_Conn  LightWell/<0>    0.000    612.11
                3Floor_Conn  LightWell/<0>    0.000    612.11
                3Floor_Conn  VentStack_E/<1>   -0.000   -1002.39
                3Floor_Conn  LightWell/<0>    0.000    612.11
                3Floor_Conn  VentStack_S/<1>    0.000      0.16
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET7.5+FAN1.5** **TUE JAN 19 14:38:14 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 7.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.008	68.0	3Floor_Conn	Main/<3>	-0.000	-651.63	
			3Floor_Conn	Main/<3>	-0.000	-651.63	
			3Floor_Conn	Main/<3>	-0.000	-651.63	
			3Floor_Conn	Main/<3>	-0.000	-651.63	
			2Floor_Conn	Main/<2>	-0.000	-380.12	
			2Floor_Conn	Main/<2>	-0.000	-380.12	
			2Floor_Conn	Main/<2>	-0.000	-380.12	
			2Floor_Conn	Main/<2>	-0.000	-380.12	
			1Floor_Conn	Main/<1>	-0.000	-515.87	
			1Floor_Conn	Main/<1>	-0.000	-515.87	
			1Floor_Conn	Main/<1>	-0.000	-515.87	
			1Floor_Conn	Main/<1>	-0.000	-515.87	
			Filter	Ambt	0.008	604.79	
			Filter	Ambt	0.008	604.79	
			Filter	Ambt	0.008	584.57	
			Filter	Ambt	0.008	584.57	
			Fan1.5	Ambt	0.007	1519.66	
			Filter	Ambt	0.008	584.57	
			Filter	Ambt	0.008	584.57	
			Filter	Ambt	0.008	561.47	
			Filter	Ambt	0.008	561.47	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.007	68.0	VentOutlet	Ambt	-0.001	-1275.81	1.52
			3Floor_Conn	Main/<3>	0.000	536.54	
			2Floor_Conn	Main/<2>	0.000	312.98	
			1Floor_Conn	Main/<1>	0.000	424.76	
Main	-0.007	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-424.76	

```
                   1Floor_Conn  LightWell/<0>     0.000     515.87
                   1Floor_Conn  VentStack_W/<1>   -0.000    -819.43
                   1Floor_Conn  LightWell/<0>     0.000     515.87
                   1Floor_Conn  LightWell/<0>     0.000     515.87
                   1Floor_Conn  VentStack_E/<1>   -0.000    -819.43
                   1Floor_Conn  LightWell/<0>     0.000     515.87
                   1Floor_Conn  VentStack_S/<1>    0.000       0.12

VentStack_W  -0.007  68.0  VentOutlet    Ambt     -0.002  -2458.28
                   3Floor_Conn  Main/<3>     0.000   1035.07
                   2Floor_Conn  Main/<2>     0.000    603.79
                   1Floor_Conn  Main/<1>     0.000    819.43

VentStack_E  -0.007  68.0  VentOutlet    Ambt     -0.002  -2458.28
                   3Floor_Conn  Main/<3>     0.000   1035.07
                   2Floor_Conn  Main/<2>     0.000    603.79
                   1Floor_Conn  Main/<1>     0.000    819.43

VentStack_S  -0.007  68.0  BackdraftRoof  Ambt     0.009      0.36
                   3Floor_Conn  Main/<3>    -0.000     -0.15
                   2Floor_Conn  Main/<2>    -0.000     -0.09
                   1Floor_Conn  Main/<1>    -0.000     -0.12

level: <2>   elevation: 13.1 ft

zone    P     T    path      from        dP     Flow1    Flow2
Main  -0.005  68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -312.98
                   2Floor_Conn  LightWell/<0>     0.000    380.12
                   2Floor_Conn  VentStack_W/<1>   -0.000   -603.79
                   2Floor_Conn  LightWell/<0>     0.000    380.12
                   2Floor_Conn  LightWell/<0>     0.000    380.12
                   2Floor_Conn  VentStack_E/<1>   -0.000   -603.79
                   2Floor_Conn  LightWell/<0>     0.000    380.12
                   2Floor_Conn  VentStack_S/<1>    0.000      0.09

level: <3>   elevation: 23.0 ft

zone    P     T    path      from        dP     Flow1    Flow2
Main  -0.003  68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -536.54
                   3Floor_Conn  LightWell/<0>     0.000    651.63
                   3Floor_Conn  VentStack_W/<1>   -0.000  -1035.07
                   3Floor_Conn  LightWell/<0>     0.000    651.63
                   3Floor_Conn  LightWell/<0>     0.000    651.63
                   3Floor_Conn  VentStack_E/<1>   -0.000  -1035.07
                   3Floor_Conn  LightWell/<0>     0.000    651.63
                   3Floor_Conn  VentStack_S/<1>    0.000      0.15
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT: FILTERINLET7.5+FAN2 **TUE JAN 19 14:40:02 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 7.5 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.007	68.0	3Floor_Conn	Main/<3>	-0.000	-689.12	
			3Floor_Conn	Main/<3>	-0.000	-689.12	
			3Floor_Conn	Main/<3>	-0.000	-689.12	
			3Floor_Conn	Main/<3>	-0.000	-689.12	
			2Floor_Conn	Main/<2>	-0.000	-401.99	
			2Floor_Conn	Main/<2>	-0.000	-401.99	
			2Floor_Conn	Main/<2>	-0.000	-401.99	
			2Floor_Conn	Main/<2>	-0.000	-401.99	
			1Floor_Conn	Main/<1>	-0.000	-545.56	
			1Floor_Conn	Main/<1>	-0.000	-545.56	
			1Floor_Conn	Main/<1>	-0.000	-545.56	
			1Floor_Conn	Main/<1>	-0.000	-545.56	
			Filter	Ambt	0.008	586.00	
			Filter	Ambt	0.008	586.00	
			Filter	Ambt	0.008	565.78	
			Filter	Ambt	0.008	565.78	
			Fan2	Ambt	0.007	2026.22	
			Filter	Ambt	0.008	565.78	
			Filter	Ambt	0.008	565.78	
			Filter	Ambt	0.008	542.67	
			Filter	Ambt	0.008	542.67	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.007	68.0	VentOutlet	Ambt	-0.001	-1456.75	
			3Floor_Conn	Main/<3>	0.000	613.37	
			2Floor_Conn	Main/<2>	0.000	357.80	
			1Floor_Conn	Main/<1>	0.000	485.58	
Main	-0.007	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-485.58	
			1Floor_Conn	LightWell/<0>	0.000	545.56	

```
                1Floor_Conn  VentStack_W/<1>    -0.000    -848.38
                1Floor_Conn  LightWell/<0>     0.000     545.56
                1Floor_Conn  LightWell/<0>     0.000     545.56
                1Floor_Conn  VentStack_E/<1>    -0.000    -848.38
                1Floor_Conn  LightWell/<0>     0.000     545.56
                1Floor_Conn  VentStack_S/<1>     0.000      0.12

VentStack_W   -0.007   68.0  VentOutlet     Ambt     -0.002   -2545.14
                3Floor_Conn  Main/<3>    0.000    1071.64
                2Floor_Conn  Main/<2>    0.000     625.12
                1Floor_Conn  Main/<1>    0.000     848.38

VentStack_E   -0.007   68.0  VentOutlet     Ambt     -0.002   -2545.14
                3Floor_Conn  Main/<3>    0.000    1071.64
                2Floor_Conn  Main/<2>    0.000     625.12
                1Floor_Conn  Main/<1>    0.000     848.38

VentStack_S   -0.007   68.0  BackdraftRoof   Ambt      0.008      0.36
                3Floor_Conn  Main/<3>   -0.000     -0.15
                2Floor_Conn  Main/<2>   -0.000     -0.09
                1Floor_Conn  Main/<1>   -0.000     -0.12

level: <2>    elevation: 13.1 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.005   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -357.80
                2Floor_Conn  LightWell/<0>     0.000     401.99
                2Floor_Conn  VentStack_W/<1>    -0.000    -625.12
                2Floor_Conn  LightWell/<0>     0.000     401.99
                2Floor_Conn  LightWell/<0>     0.000     401.99
                2Floor_Conn  VentStack_E/<1>    -0.000    -625.12
                2Floor_Conn  LightWell/<0>     0.000     401.99
                2Floor_Conn  VentStack_S/<1>     0.000      0.09

level: <3>    elevation: 23.0 ft

zone      P      T      path       from         dP      Flow1      Flow2
Main   -0.003   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -613.37
                3Floor_Conn  LightWell/<0>     0.000     689.12
                3Floor_Conn  VentStack_W/<1>    -0.000   -1071.64
                3Floor_Conn  LightWell/<0>     0.000     689.12
                3Floor_Conn  LightWell/<0>     0.000     689.12
                3Floor_Conn  VentStack_E/<1>    -0.000   -1071.64
                3Floor_Conn  LightWell/<0>     0.000     689.12
                3Floor_Conn  VentStack_S/<1>     0.000      0.15
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET15** **MON JAN 18 14:45:49 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 15.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.012	68.0	3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			3Floor_Conn	Main/<3>	-0.000	-942.26	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			2Floor_Conn	Main/<2>	-0.000	-549.66	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			1Floor_Conn	Main/<1>	-0.000	-745.96	
			Filter	Ambt	0.014	1202.70	
			Filter	Ambt	0.014	1202.70	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.013	1121.83	
			Filter	Ambt	0.012	1029.41	
			Filter	Ambt	0.012	1029.41	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.011	68.0	VentOutlet	Ambt	-0.000	-752.79	219.25
			3Floor_Conn	Main/<3>	0.000	224.65	
			2Floor_Conn	Main/<2>	0.000	131.04	
			1Floor_Conn	Main/<1>	0.000	177.84	
Main	-0.011	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-177.84	
			1Floor_Conn	LightWell/<0>	0.000	745.96	

```
                1Floor_Conn  VentStack_W/<1>   -0.001  -1403.16
                1Floor_Conn  LightWell/<0>    0.000    745.96
                1Floor_Conn  LightWell/<0>    0.000    745.96
                1Floor_Conn  VentStack_E/<1>   -0.001  -1403.16
                1Floor_Conn  LightWell/<0>    0.000    745.96
                1Floor_Conn  VentStack_S/<1>    0.000      0.34

VentStack_W   -0.012   68.0  VentOutlet    Ambt    -0.006   -4209.49
                3Floor_Conn  Main/<3>    0.001   1772.42
                2Floor_Conn  Main/<2>    0.001   1033.91
                1Floor_Conn  Main/<1>    0.001   1403.16

VentStack_E   -0.012   68.0  VentOutlet    Ambt    -0.006   -4209.49
                3Floor_Conn  Main/<3>    0.001   1772.42
                2Floor_Conn  Main/<2>    0.001   1033.91
                1Floor_Conn  Main/<1>    0.001   1403.16

VentStack_S   -0.011   68.0  BackdraftRoof   Ambt     0.037      1.01
                3Floor_Conn  Main/<3>   -0.000     -0.43
                2Floor_Conn  Main/<2>   -0.000     -0.25
                1Floor_Conn  Main/<1>   -0.000     -0.34

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.009   68.0  2Floor_Conn  VentStack_N/<1>   -0.000   -131.04
                2Floor_Conn  LightWell/<0>    0.000    549.66
                2Floor_Conn  VentStack_W/<1>   -0.001  -1033.91
                2Floor_Conn  LightWell/<0>    0.000    549.66
                2Floor_Conn  LightWell/<0>    0.000    549.66
                2Floor_Conn  VentStack_E/<1>   -0.001  -1033.91
                2Floor_Conn  LightWell/<0>    0.000    549.66
                2Floor_Conn  VentStack_S/<1>    0.000      0.25

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.007   68.0  3Floor_Conn  VentStack_N/<1>   -0.000   -224.65
                3Floor_Conn  LightWell/<0>    0.000    942.26
                3Floor_Conn  VentStack_W/<1>   -0.001  -1772.42
                3Floor_Conn  LightWell/<0>    0.000    942.26
                3Floor_Conn  LightWell/<0>    0.000    942.26
                3Floor_Conn  VentStack_E/<1>   -0.001  -1772.42
                3Floor_Conn  LightWell/<0>    0.000    942.26
                3Floor_Conn  VentStack_S/<1>    0.000      0.43
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET15+FAN1** **THU FEB 04 20:38:15 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 15.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.011	68.0	3Floor_Conn	Main/<3>	-0.000	-1018.65	
			3Floor_Conn	Main/<3>	-0.000	-1018.65	
			3Floor_Conn	Main/<3>	-0.000	-1018.65	
			3Floor_Conn	Main/<3>	-0.000	-1018.65	
			2Floor_Conn	Main/<2>	-0.000	-594.21	
			2Floor_Conn	Main/<2>	-0.000	-594.21	
			2Floor_Conn	Main/<2>	-0.000	-594.21	
			2Floor_Conn	Main/<2>	-0.000	-594.21	
			1Floor_Conn	Main/<1>	-0.000	-806.43	
			1Floor_Conn	Main/<1>	-0.000	-806.43	
			1Floor_Conn	Main/<1>	-0.000	-806.43	
			1Floor_Conn	Main/<1>	-0.000	-806.43	
			Filter	Ambt	0.014	1166.76	
			Filter	Ambt	0.014	1166.76	
			Filter	Ambt	0.013	1085.89	
			Filter	Ambt	0.013	1085.89	
			Fan1	Ambt	0.011	1013.11	
			Filter	Ambt	0.013	1085.89	
			Filter	Ambt	0.013	1085.89	
			Filter	Ambt	0.012	993.47	
			Filter	Ambt	0.012	993.47	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.011	68.0	VentOutlet	Ambt	-0.001	-1112.50	39.68
			3Floor_Conn	Main/<3>	0.000	451.71	
			2Floor_Conn	Main/<2>	0.000	263.50	
			1Floor_Conn	Main/<1>	0.000	357.61	
Main	-0.011	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-357.61	

```
                 1Floor_Conn  LightWell/<0>    0.000    806.43
                 1Floor_Conn  VentStack_W/<1>   -0.001   -1434.22
                 1Floor_Conn  LightWell/<0>    0.000    806.43
                 1Floor_Conn  LightWell/<0>    0.000    806.43
                 1Floor_Conn  VentStack_E/<1>   -0.001   -1434.22
                 1Floor_Conn  LightWell/<0>    0.000    806.43
                 1Floor_Conn  VentStack_S/<1>    0.000      0.34

VentStack_W   -0.012   68.0  VentOutlet    Ambt     -0.006   -4302.67
                 3Floor_Conn  Main/<3>    0.001    1811.65
                 2Floor_Conn  Main/<2>    0.001    1056.80
                 1Floor_Conn  Main/<1>    0.001    1434.22

VentStack_E   -0.012   68.0  VentOutlet    Ambt     -0.006   -4302.67
                 3Floor_Conn  Main/<3>    0.001    1811.65
                 2Floor_Conn  Main/<2>    0.001    1056.80
                 1Floor_Conn  Main/<1>    0.001    1434.22

VentStack_S   -0.011   68.0  BackdraftRoof   Ambt      0.037      1.01
                 3Floor_Conn  Main/<3>   -0.000     -0.42
                 2Floor_Conn  Main/<2>   -0.000     -0.25
                 1Floor_Conn  Main/<1>   -0.000     -0.34

level: <2>    elevation: 13.1 ft

zone     P     T     path       from        dP     Flow1     Flow2
Main   -0.009   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -263.50
                 2Floor_Conn  LightWell/<0>    0.000    594.21
                 2Floor_Conn  VentStack_W/<1>   -0.001   -1056.80
                 2Floor_Conn  LightWell/<0>    0.000    594.21
                 2Floor_Conn  LightWell/<0>    0.000    594.21
                 2Floor_Conn  VentStack_E/<1>   -0.001   -1056.80
                 2Floor_Conn  LightWell/<0>    0.000    594.21
                 2Floor_Conn  VentStack_S/<1>    0.000      0.25

level: <3>    elevation: 23.0 ft

zone     P     T     path       from        dP     Flow1     Flow2
Main   -0.007   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -451.71
                 3Floor_Conn  LightWell/<0>    0.000   1018.65
                 3Floor_Conn  VentStack_W/<1>   -0.001   -1811.65
                 3Floor_Conn  LightWell/<0>    0.000   1018.65
                 3Floor_Conn  LightWell/<0>    0.000   1018.65
                 3Floor_Conn  VentStack_E/<1>   -0.001   -1811.65
                 3Floor_Conn  LightWell/<0>    0.000   1018.65
                 3Floor_Conn  VentStack_S/<1>    0.000      0.42
```

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET15+FAN1.5** **THU FEB 04 20:42:33 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 15.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.011	68.0	3Floor_Conn	Main/<3>	-0.000	-1055.41	
			3Floor_Conn	Main/<3>	-0.000	-1055.41	
			3Floor_Conn	Main/<3>	-0.000	-1055.41	
			3Floor_Conn	Main/<3>	-0.000	-1055.41	
			2Floor_Conn	Main/<2>	-0.000	-615.66	
			2Floor_Conn	Main/<2>	-0.000	-615.66	
			2Floor_Conn	Main/<2>	-0.000	-615.66	
			2Floor_Conn	Main/<2>	-0.000	-615.66	
			1Floor_Conn	Main/<1>	-0.000	-835.53	
			1Floor_Conn	Main/<1>	-0.000	-835.53	
			1Floor_Conn	Main/<1>	-0.000	-835.53	
			1Floor_Conn	Main/<1>	-0.000	-835.53	
			Filter	Ambt	0.013	1147.09	
			Filter	Ambt	0.013	1147.09	
			Filter	Ambt	0.013	1066.23	
			Filter	Ambt	0.013	1066.23	
			Fan1.5	Ambt	0.011	1519.66	
			Filter	Ambt	0.013	1066.23	
			Filter	Ambt	0.013	1066.23	
			Filter	Ambt	0.012	973.80	
			Filter	Ambt	0.012	973.80	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.011	68.0	VentOutlet	Ambt	-0.001	-1320.93	
			3Floor_Conn	Main/<3>	0.000	556.18	
			2Floor_Conn	Main/<2>	0.000	324.44	
			1Floor_Conn	Main/<1>	0.000	440.31	
Main	-0.011	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-440.31	

			1Floor_Conn	LightWell/<0>	0.000	835.53	
			1Floor_Conn	VentStack_W/<1>	-0.001	-1451.07	
			1Floor_Conn	LightWell/<0>	0.000	835.53	
			1Floor_Conn	LightWell/<0>	0.000	835.53	
			1Floor_Conn	VentStack_E/<1>	-0.001	-1451.07	
			1Floor_Conn	LightWell/<0>	0.000	835.53	
			1Floor_Conn	VentStack_S/<1>	0.000	0.33	
VentStack_W	-0.012	68.0	VentOutlet	Ambt	-0.007	-4353.22	
			3Floor_Conn	Main/<3>	0.001	1832.93	
			2Floor_Conn	Main/<2>	0.001	1069.22	
			1Floor_Conn	Main/<1>	0.001	1451.07	
VentStack_E	-0.012	68.0	VentOutlet	Ambt	-0.007	-4353.22	
			3Floor_Conn	Main/<3>	0.001	1832.93	
			2Floor_Conn	Main/<2>	0.001	1069.22	
			1Floor_Conn	Main/<1>	0.001	1451.07	
VentStack_S	-0.011	68.0	BackdraftRoof	Ambt	0.036	1.00	
			3Floor_Conn	Main/<3>	-0.000	-0.42	
			2Floor_Conn	Main/<2>	-0.000	-0.25	
			1Floor_Conn	Main/<1>	-0.000	-0.33	

level: <2> elevation: 13.1 ft

zone	P	T	path	from	dP	Flow1	Flow2
Main	-0.009	68.0	2Floor_Conn	VentStack_N/<1>	-0.000	-324.44	
			2Floor_Conn	LightWell/<0>	0.000	615.66	
			2Floor_Conn	VentStack_W/<1>	-0.001	-1069.22	
			2Floor_Conn	LightWell/<0>	0.000	615.66	
			2Floor_Conn	LightWell/<0>	0.000	615.66	
			2Floor_Conn	VentStack_E/<1>	-0.001	-1069.22	
			2Floor_Conn	LightWell/<0>	0.000	615.66	
			2Floor_Conn	VentStack_S/<1>	0.000	0.25	

level: <3> elevation: 23.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
Main	-0.007	68.0	3Floor_Conn	VentStack_N/<1>	-0.000	-556.18	
			3Floor_Conn	LightWell/<0>	0.000	1055.41	
			3Floor_Conn	VentStack_W/<1>	-0.001	-1832.93	
			3Floor_Conn	LightWell/<0>	0.000	1055.41	
			3Floor_Conn	LightWell/<0>	0.000	1055.41	
			3Floor_Conn	VentStack_E/<1>	-0.001	-1832.93	
			3Floor_Conn	LightWell/<0>	0.000	1055.41	
			3Floor_Conn	VentStack_S/<1>	0.000	0.42	

level: <4>   elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

PROJECT**: FILTERINLET15+FAN2** **THU FEB 04 20:44:03 2010**

description: Glasgow

simulation date: Jan01
simulation time: 00:00:00
ambient temperature: 16.0 °C
barometric pressure: 101252.9 Pa
wind speed: 15.0 mph
wind direction: 0.0 deg

level: <0> elevation: 0.0 ft

zone	P	T	path	from	dP	Flow1	Flow2
LightWell	-0.011	68.0	3Floor_Conn	Main/<3>	-0.000	-1089.31	
			3Floor_Conn	Main/<3>	-0.000	-1089.31	
			3Floor_Conn	Main/<3>	-0.000	-1089.31	
			3Floor_Conn	Main/<3>	-0.000	-1089.31	
			2Floor_Conn	Main/<2>	-0.000	-635.43	
			2Floor_Conn	Main/<2>	-0.000	-635.43	
			2Floor_Conn	Main/<2>	-0.000	-635.43	
			2Floor_Conn	Main/<2>	-0.000	-635.43	
			1Floor_Conn	Main/<1>	-0.000	-862.37	
			1Floor_Conn	Main/<1>	-0.000	-862.37	
			1Floor_Conn	Main/<1>	-0.000	-862.37	
			1Floor_Conn	Main/<1>	-0.000	-862.37	
			Filter	Ambt	0.013	1124.04	
			Filter	Ambt	0.013	1124.04	
			Filter	Ambt	0.012	1043.17	
			Filter	Ambt	0.012	1043.17	
			Fan2	Ambt	0.011	2026.22	
			Filter	Ambt	0.012	1043.17	
			Filter	Ambt	0.012	1043.17	
			Filter	Ambt	0.011	950.75	
			Filter	Ambt	0.011	950.75	

level: <1> elevation: 3.3 ft

zone	P	T	path	from	dP	Flow1	Flow2
VentStack_N	-0.011	68.0	VentOutlet	Ambt	-0.001	-1523.70	
			3Floor_Conn	Main/<3>	0.000	641.56	
			2Floor_Conn	Main/<2>	0.000	374.24	
			1Floor_Conn	Main/<1>	0.000	507.90	
Main	-0.011	68.0	1Floor_Conn	VentStack_N/<1>	-0.000	-507.90	

```
               1Floor_Conn  LightWell/<0>     0.000     862.37
               1Floor_Conn  VentStack_W/<1>   -0.001   -1470.96
               1Floor_Conn  LightWell/<0>     0.000     862.37
               1Floor_Conn  LightWell/<0>     0.000     862.37
               1Floor_Conn  VentStack_E/<1>   -0.001   -1470.96
               1Floor_Conn  LightWell/<0>     0.000     862.37
               1Floor_Conn  VentStack_S/<1>    0.000       0.33

VentStack_W   -0.011   68.0  VentOutlet     Ambt     -0.007   -4412.89
               3Floor_Conn  Main/<3>    0.001    1858.06
               2Floor_Conn  Main/<2>    0.001    1083.87
               1Floor_Conn  Main/<1>    0.001    1470.96

VentStack_E   -0.011   68.0  VentOutlet     Ambt     -0.007   -4412.89
               3Floor_Conn  Main/<3>    0.001    1858.06
               2Floor_Conn  Main/<2>    0.001    1083.87
               1Floor_Conn  Main/<1>    0.001    1470.96

VentStack_S   -0.011   68.0  BackdraftRoof   Ambt      0.036      1.00
               3Floor_Conn  Main/<3>   -0.000     -0.42
               2Floor_Conn  Main/<2>   -0.000     -0.25
               1Floor_Conn  Main/<1>   -0.000     -0.33

level: <2>    elevation: 13.1 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.009   68.0  2Floor_Conn  VentStack_N/<1>    -0.000    -374.24
               2Floor_Conn  LightWell/<0>     0.000     635.43
               2Floor_Conn  VentStack_W/<1>   -0.001   -1083.87
               2Floor_Conn  LightWell/<0>     0.000     635.43
               2Floor_Conn  LightWell/<0>     0.000     635.43
               2Floor_Conn  VentStack_E/<1>   -0.001   -1083.87
               2Floor_Conn  LightWell/<0>     0.000     635.43
               2Floor_Conn  VentStack_S/<1>    0.000       0.25

level: <3>    elevation: 23.0 ft

zone     P      T     path       from        dP     Flow1     Flow2
Main   -0.007   68.0  3Floor_Conn  VentStack_N/<1>    -0.000    -641.56
               3Floor_Conn  LightWell/<0>     0.000    1089.31
               3Floor_Conn  VentStack_W/<1>   -0.001   -1858.06
               3Floor_Conn  LightWell/<0>     0.000    1089.31
               3Floor_Conn  LightWell/<0>     0.000    1089.31
               3Floor_Conn  VentStack_E/<1>   -0.001   -1858.06
               3Floor_Conn  LightWell/<0>     0.000    1089.31
               3Floor_Conn  VentStack_S/<1>    0.000       0.42
```

level: <4> elevation: 32.8 ft

zone	P	T	path	from	dP	Flow1	Flow2

Note:
flows in scfm
pressures in in.H2O
temperatures in °F
* indicates limit exceeded

APPENDIX C

USBR RAW WIND DATA

USBR HYDROMET/AGRIMET HOURLY DATA

ABEI

DATE TIME	WD	WS
01/01/2010 00:00	201.70	13.18
01/01/2010 01:00	204.90	11.15
01/01/2010 02:00	206.80	14.01
01/01/2010 03:00	116.90	2.34
01/01/2010 04:00	186.60	8.20
01/01/2010 05:00	52.73	2.12
01/01/2010 06:00	115.70	1.63
01/01/2010 07:00	285.80	1.58
01/01/2010 08:00	109.00	2.03
01/01/2010 09:00	36.26	2.88
01/01/2010 10:00	282.60	2.05
01/01/2010 11:00	17.89	2.69
01/01/2010 12:00	135.70	2.68
01/01/2010 13:00	191.40	6.77
01/01/2010 14:00	183.10	8.07
01/01/2010 15:00	203.50	10.44
01/01/2010 16:00	197.20	8.37
01/01/2010 17:00	162.50	5.75
01/01/2010 18:00	183.30	2.83
01/01/2010 19:00	165.70	6.55
01/01/2010 20:00	163.00	7.59
01/01/2010 21:00	162.40	4.82
01/01/2010 22:00	183.40	6.28
01/01/2010 23:00	158.70	5.44
01/02/2010 00:00	181.40	5.90
01/02/2010 01:00	224.50	4.33
01/02/2010 02:00	185.40	8.13
01/02/2010 03:00	202.40	9.11
01/02/2010 04:00	238.80	12.31
01/02/2010 05:00	240.30	10.47
01/02/2010 06:00	228.90	9.39
01/02/2010 07:00	239.80	8.48
01/02/2010 08:00	255.00	12.09
01/02/2010 09:00	247.70	10.98
01/02/2010 10:00	237.50	8.11
01/02/2010 11:00	252.60	6.57

01/02/2010 12:00	230.70	6.22
01/02/2010 13:00	235.40	11.25
01/02/2010 14:00	239.80	6.70
01/02/2010 15:00	218.50	9.13
01/02/2010 16:00	238.00	10.40
01/02/2010 17:00	231.00	8.20
01/02/2010 18:00	237.30	5.13
01/02/2010 19:00	227.20	4.60
01/02/2010 20:00	200.80	3.02
01/02/2010 21:00	65.42	2.05
01/02/2010 22:00	283.50	2.74
01/02/2010 23:00	285.30	3.21
01/03/2010 00:00	30.64	0.67
01/03/2010 01:00	267.40	2.78
01/03/2010 02:00	47.41	1.06
01/03/2010 03:00	263.70	1.21
01/03/2010 04:00	344.60	2.51
01/03/2010 05:00	353.60	1.22
01/03/2010 06:00	284.90	2.40
01/03/2010 07:00	285.80	0.99
01/03/2010 08:00	282.90	1.53
01/03/2010 09:00	295.00	2.58
01/03/2010 10:00	43.18	1.55
01/03/2010 11:00	33.56	1.32
01/03/2010 12:00	59.27	2.40
01/03/2010 13:00	51.38	3.93
01/03/2010 14:00	54.54	2.87
01/03/2010 15:00	24.37	4.59
01/03/2010 16:00	51.88	2.69
01/03/2010 17:00	12.62	3.03
01/03/2010 18:00	14.88	3.46
01/03/2010 19:00	12.33	3.07
01/03/2010 20:00	347.30	3.91
01/03/2010 21:00	344.00	3.31
01/03/2010 22:00	325.10	3.32
01/03/2010 23:00	302.00	2.80
01/04/2010 00:00	327.90	2.35
01/04/2010 01:00	349.30	3.54
01/04/2010 02:00	353.20	1.82
01/04/2010 03:00	72.62	2.08
01/04/2010 04:00	38.67	2.40
01/04/2010 05:00	7.94	4.40
01/04/2010 06:00	34.50	3.73
01/04/2010 07:00	14.77	2.59
01/04/2010 08:00	341.70	0.65
01/04/2010 09:00	12.50	3.94

01/04/2010 10:00	31.54	5.34
01/04/2010 11:00	29.82	10.85
01/04/2010 12:00	23.74	9.76
01/04/2010 13:00	19.64	9.48
01/04/2010 14:00	25.82	9.16
01/04/2010 15:00	19.10	8.68
01/04/2010 16:00	20.38	6.55
01/04/2010 17:00	9.60	5.67
01/04/2010 18:00	23.47	5.22
01/04/2010 19:00	324.30	3.06
01/04/2010 20:00	320.50	2.79
01/04/2010 21:00	333.90	0.96
01/04/2010 22:00	316.40	4.22
01/04/2010 23:00	296.90	3.11
01/05/2010 00:00	335.40	3.35
01/05/2010 01:00	121.70	1.61
01/05/2010 02:00	124.20	1.81
01/05/2010 03:00	158.20	2.15
01/05/2010 04:00	159.40	2.61
01/05/2010 05:00	113.20	1.89
01/05/2010 06:00	354.40	5.23
01/05/2010 07:00	347.40	3.95
01/05/2010 08:00	324.40	4.23
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01/05/2010 10:00	290.10	1.87
01/05/2010 11:00	345.40	1.61
01/05/2010 12:00	8.13	0.30
01/05/2010 13:00	191.30	7.81
01/05/2010 14:00	220.30	8.73
01/05/2010 15:00	204.10	11.43
01/05/2010 16:00	180.10	6.46
01/05/2010 17:00	202.20	8.99
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01/05/2010 19:00	212.10	8.89
01/05/2010 20:00	221.90	11.09
01/05/2010 21:00	217.80	9.14
01/05/2010 22:00	195.60	8.17
01/05/2010 23:00	219.30	7.98
01/06/2010 00:00	216.90	10.04
01/06/2010 01:00	209.70	9.63
01/06/2010 02:00	223.40	9.16
01/06/2010 03:00	222.80	7.49
01/06/2010 04:00	233.20	7.32
01/06/2010 05:00	222.80	5.56
01/06/2010 06:00	262.00	13.11
01/06/2010 07:00	252.40	11.02

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01/06/2010 10:00	18.06	15.47
01/06/2010 11:00	30.66	19.39
01/06/2010 12:00	32.03	18.97
01/06/2010 13:00	41.57	20.09
01/06/2010 14:00	41.70	21.61
01/06/2010 15:00	42.13	18.25
01/06/2010 16:00	40.43	16.06
01/06/2010 17:00	40.73	10.49
01/06/2010 18:00	34.00	12.84
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01/06/2010 21:00	9.93	7.33
01/06/2010 22:00	39.29	8.99
01/06/2010 23:00	356.10	7.29
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01/07/2010 02:00	7.98	5.38
01/07/2010 03:00	10.95	7.31
01/07/2010 04:00	32.49	4.36
01/07/2010 05:00	27.54	7.36
01/07/2010 06:00	7.88	4.84
01/07/2010 07:00	332.80	4.87
01/07/2010 08:00	357.60	7.27
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01/07/2010 10:00	6.81	4.29
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01/07/2010 12:00	7.54	6.95
01/07/2010 13:00	56.51	3.71
01/07/2010 14:00	54.13	3.23
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01/07/2010 16:00	68.04	3.65
01/07/2010 17:00	9.86	3.07
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01/07/2010 20:00	17.40	2.92
01/07/2010 21:00	344.20	2.48
01/07/2010 22:00	356.00	3.20
01/07/2010 23:00	89.70	0.71
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01/08/2010 01:00	3.90	4.84
01/08/2010 02:00	353.90	6.22
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01/08/2010 04:00	346.60	3.51
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01/08/2010 18:00	9.86	5.36
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01/08/2010 22:00	14.58	6.35
01/08/2010 23:00	3.23	5.92
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01/09/2010 12:00	11.37	7.80
01/09/2010 13:00	35.50	5.57
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01/09/2010 16:00	4.22	6.57
01/09/2010 17:00	23.80	7.31
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01/09/2010 19:00	41.52	4.24
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01/09/2010 21:00	10.94	8.58
01/09/2010 22:00	13.82	4.63
01/09/2010 23:00	31.48	5.33
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01/10/2010 01:00	21.63	5.59
01/10/2010 02:00	7.00	6.82
01/10/2010 03:00	3.84	4.98

01/10/2010 04:00	357.90	6.54
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01/10/2010 07:00	25.78	5.91
01/10/2010 08:00	350.20	4.52
01/10/2010 09:00	18.38	4.99
01/10/2010 10:00	27.12	3.13
01/10/2010 11:00	16.19	6.15
01/10/2010 12:00	51.03	4.89
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01/10/2010 14:00	10.64	7.34
01/10/2010 15:00	30.02	9.17
01/10/2010 16:00	40.81	5.52
01/10/2010 17:00	49.62	3.02
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01/11/2010 03:00	8.15	1.88
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01/11/2010 05:00	9.10	3.00
01/11/2010 06:00	2.82	2.77
01/11/2010 07:00	83.10	2.42
01/11/2010 08:00	53.43	2.49
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01/11/2010 11:00	31.69	5.69
01/11/2010 12:00	54.91	3.11
01/11/2010 13:00	40.30	8.32
01/11/2010 14:00	23.90	7.85
01/11/2010 15:00	54.98	4.01
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01/11/2010 17:00	9.51	5.76
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01/11/2010 20:00	357.00	4.44
01/11/2010 21:00	24.78	10.67
01/11/2010 22:00	352.50	5.69
01/11/2010 23:00	37.25	6.10
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01/12/2010 06:00	41.35	7.85
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01/12/2010 15:00	11.38	5.90
01/12/2010 16:00	19.26	5.93
01/12/2010 17:00	38.10	2.66
01/12/2010 18:00	25.05	5.06
01/12/2010 19:00	333.50	4.80
01/12/2010 20:00	347.30	3.26
01/12/2010 21:00	347.30	3.70
01/12/2010 22:00	54.57	3.90
01/12/2010 23:00	350.30	3.21
01/13/2010 00:00	247.30	1.31
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01/13/2010 03:00	9.06	5.32
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01/13/2010 05:00	356.20	5.42
01/13/2010 06:00	14.58	5.47
01/13/2010 07:00	21.08	3.60
01/13/2010 08:00	2.16	3.62
01/13/2010 09:00	34.68	6.98
01/13/2010 10:00	24.84	7.21
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01/13/2010 12:00	27.81	9.35
01/13/2010 13:00	18.76	6.71
01/13/2010 14:00	57.80	2.31
01/13/2010 15:00	349.10	4.35
01/13/2010 16:00	28.85	3.18
01/13/2010 17:00	298.30	2.31
01/13/2010 18:00	242.90	1.64
01/13/2010 19:00	210.60	3.71
01/13/2010 20:00	213.60	8.99
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01/13/2010 23:00	222.00	6.57

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01/14/2010 01:00	220.70	5.57
01/14/2010 02:00	207.20	5.21
01/14/2010 03:00	237.40	8.23
01/14/2010 04:00	260.90	14.36
01/14/2010 05:00	246.80	7.01
01/14/2010 06:00	229.20	7.17
01/14/2010 07:00	218.00	8.69
01/14/2010 08:00	213.10	6.80
01/14/2010 09:00	232.90	7.09
01/14/2010 10:00	234.10	0.30
01/14/2010 11:00	236.20	10.64
01/14/2010 12:00	240.40	8.94
01/14/2010 13:00	243.80	9.06
01/14/2010 14:00	251.30	11.24
01/14/2010 15:00	248.50	11.01
01/14/2010 16:00	237.30	8.67
01/14/2010 17:00	230.10	7.69
01/14/2010 18:00	226.00	7.14
01/14/2010 19:00	210.40	4.99
01/14/2010 20:00	237.40	4.43
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01/14/2010 22:00	26.17	2.26
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01/15/2010 00:00	2.34	0.30
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01/15/2010 08:00	353.50	3.63
01/15/2010 09:00	344.80	4.50
01/15/2010 10:00	0.58	3.69
01/15/2010 11:00	37.71	4.96
01/15/2010 12:00	7.57	8.24
01/15/2010 13:00	11.77	10.58
01/15/2010 14:00	22.68	11.62
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01/15/2010 23:00	353.80	3.81
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01/16/2010 02:00	11.89	4.78
01/16/2010 03:00	15.00	8.71
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01/16/2010 16:00	80.50	3.61
01/16/2010 17:00	338.10	4.00
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01/16/2010 19:00	324.20	2.99
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01/16/2010 22:00	6.59	4.60
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01/17/2010 03:00	0.94	4.20
01/17/2010 04:00	324.60	3.01
01/17/2010 05:00	8.36	3.48
01/17/2010 06:00	43.65	2.94
01/17/2010 07:00	348.90	4.76
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01/17/2010 16:00	18.95	3.43
01/17/2010 17:00	43.45	3.83
01/17/2010 18:00	0.27	6.67
01/17/2010 19:00	35.28	2.84

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01/17/2010 21:00	338.80	4.58
01/17/2010 22:00	314.10	3.55
01/17/2010 23:00	68.28	2.59
01/18/2010 00:00	66.64	3.18
01/18/2010 01:00	358.50	5.04
01/18/2010 02:00	8.76	7.59
01/18/2010 03:00	292.30	3.98
01/18/2010 04:00	334.50	2.70
01/18/2010 05:00	162.70	2.69
01/18/2010 06:00	136.00	2.54
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01/18/2010 08:00	355.70	2.47
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01/18/2010 12:00	352.20	3.04
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01/18/2010 19:00	124.40	5.48
01/18/2010 20:00	45.48	8.00
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01/19/2010 02:00	196.90	2.89
01/19/2010 03:00	176.30	15.01
01/19/2010 04:00	223.70	8.59
01/19/2010 05:00	195.90	10.00
01/19/2010 06:00	187.20	5.36
01/19/2010 07:00	214.40	7.07
01/19/2010 08:00	201.30	6.61
01/19/2010 09:00	158.80	5.54
01/19/2010 10:00	193.50	3.05
01/19/2010 11:00	202.50	5.34
01/19/2010 12:00	189.30	7.65
01/19/2010 13:00	197.30	10.37
01/19/2010 14:00	197.50	11.37
01/19/2010 15:00	183.10	11.02
01/19/2010 16:00	188.30	9.37
01/19/2010 17:00	138.60	4.52

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01/19/2010 19:00	148.00	10.62
01/19/2010 20:00	151.20	3.01
01/19/2010 21:00	205.10	3.26
01/19/2010 22:00	34.72	5.55
01/19/2010 23:00	33.88	6.02
01/20/2010 00:00	7.42	7.50
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01/20/2010 02:00	13.13	7.30
01/20/2010 03:00	345.30	5.12
01/20/2010 04:00	353.10	4.74
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01/20/2010 09:00	6.48	6.74
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01/20/2010 12:00	30.79	4.36
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01/20/2010 17:00	107.30	3.58
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01/20/2010 19:00	169.90	1.66
01/20/2010 20:00	129.00	5.52
01/20/2010 21:00	140.30	6.42
01/20/2010 22:00	133.70	5.55
01/20/2010 23:00	152.40	5.94
01/21/2010 00:00	151.10	5.91
01/21/2010 01:00	152.60	7.77
01/21/2010 02:00	156.20	9.85
01/21/2010 03:00	119.00	4.29
01/21/2010 04:00	129.20	4.01
01/21/2010 05:00	102.40	4.55
01/21/2010 06:00	138.50	5.86
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01/21/2010 08:00	138.50	3.63
01/21/2010 09:00	276.90	0.95
01/21/2010 10:00	213.80	4.46
01/21/2010 11:00	105.80	2.25
01/21/2010 12:00	10.83	4.47
01/21/2010 13:00	355.80	3.04
01/21/2010 14:00	22.72	5.37
01/21/2010 15:00	24.86	5.68

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01/21/2010 17:00	48.28	4.48
01/21/2010 18:00	75.88	5.55
01/21/2010 19:00	45.89	4.60
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01/21/2010 21:00	35.02	9.47
01/21/2010 22:00	19.68	10.48
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01/22/2010 02:00	41.74	11.76
01/22/2010 03:00	37.17	10.70
01/22/2010 04:00	45.32	11.29
01/22/2010 05:00	65.33	5.49
01/22/2010 06:00	58.03	3.88
01/22/2010 07:00	185.90	15.29
01/22/2010 08:00	177.00	20.24
01/22/2010 09:00	178.80	18.86
01/22/2010 10:00	193.40	13.80
01/22/2010 11:00	196.10	13.65
01/22/2010 12:00	197.80	12.00
01/22/2010 13:00	195.90	15.03
01/22/2010 14:00	194.50	13.61
01/22/2010 15:00	229.50	7.23
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01/22/2010 17:00	198.70	9.41
01/22/2010 18:00	205.40	8.45
01/22/2010 19:00	197.20	11.36
01/22/2010 20:00	197.90	6.80
01/22/2010 21:00	216.10	6.29
01/22/2010 22:00	222.30	8.09
01/22/2010 23:00	215.50	9.05
01/23/2010 00:00	221.70	6.02
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01/23/2010 03:00	212.80	9.61
01/23/2010 04:00	225.60	11.85
01/23/2010 05:00	229.10	11.89
01/23/2010 06:00	237.60	12.98
01/23/2010 07:00	240.80	13.82
01/23/2010 08:00	248.90	20.29
01/23/2010 09:00	247.40	20.74
01/23/2010 10:00	247.70	13.48
01/23/2010 11:00	247.80	16.74
01/23/2010 12:00	247.50	17.84
01/23/2010 13:00	255.80	15.13

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01/23/2010 15:00	252.00	16.81
01/23/2010 16:00	268.50	22.48
01/23/2010 17:00	259.60	21.45
01/23/2010 18:00	266.80	17.89
01/23/2010 19:00	269.00	18.01
01/23/2010 20:00	263.90	17.06
01/23/2010 21:00	260.90	16.47
01/23/2010 22:00	209.20	8.36
01/23/2010 23:00	206.50	11.72
01/24/2010 00:00	231.40	10.73
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01/24/2010 02:00	251.30	11.74
01/24/2010 03:00	266.10	13.40
01/24/2010 04:00	208.50	7.01
01/24/2010 05:00	226.30	7.65
01/24/2010 06:00	218.30	8.65
01/24/2010 07:00	215.30	8.71
01/24/2010 08:00	222.10	8.26
01/24/2010 09:00	229.80	7.65
01/24/2010 10:00	224.30	9.71
01/24/2010 11:00	225.40	10.22
01/24/2010 12:00	236.40	8.38
01/24/2010 13:00	249.20	7.13
01/24/2010 14:00	247.50	9.06
01/24/2010 15:00	241.50	7.82
01/24/2010 16:00	260.20	4.29
01/24/2010 17:00	224.90	6.10
01/24/2010 18:00	225.30	4.36
01/24/2010 19:00	14.88	4.26
01/24/2010 20:00	23.51	5.14
01/24/2010 21:00	7.89	6.17
01/24/2010 22:00	9.83	5.78
01/24/2010 23:00	16.27	6.40
01/25/2010 00:00	12.52	6.93
01/25/2010 01:00	5.75	4.28
01/25/2010 02:00	5.55	5.06
01/25/2010 03:00	13.37	5.04
01/25/2010 04:00	350.70	5.78
01/25/2010 05:00	8.41	3.57
01/25/2010 06:00	4.79	7.36
01/25/2010 07:00	10.46	4.98
01/25/2010 08:00	352.00	4.65
01/25/2010 09:00	357.30	4.56
01/25/2010 10:00	52.88	2.70
01/25/2010 11:00	1.13	3.84

01/25/2010 12:00	15.64	4.60
01/25/2010 13:00	7.92	7.43
01/25/2010 14:00	17.22	7.80
01/25/2010 15:00	39.16	7.22
01/25/2010 16:00	9.53	7.41
01/25/2010 17:00	20.70	10.45
01/25/2010 18:00	41.17	9.92
01/25/2010 19:00	29.53	9.20
01/25/2010 20:00	21.97	9.48
01/25/2010 21:00	15.07	9.75
01/25/2010 22:00	80.10	4.43
01/25/2010 23:00	35.49	11.54
01/26/2010 00:00	33.82	8.69
01/26/2010 01:00	32.20	6.45
01/26/2010 02:00	13.44	7.47
01/26/2010 03:00	18.19	9.70
01/26/2010 04:00	30.87	10.12
01/26/2010 05:00	35.91	5.97
01/26/2010 06:00	25.86	5.03
01/26/2010 07:00	46.53	5.39
01/26/2010 08:00	41.75	5.82
01/26/2010 09:00	33.52	6.10
01/26/2010 10:00	343.20	3.44
01/26/2010 11:00	327.30	4.79
01/26/2010 12:00	5.64	5.33
01/26/2010 13:00	34.16	5.53
01/26/2010 14:00	32.87	1.19
01/26/2010 15:00	160.00	8.05
01/26/2010 16:00	188.40	5.08
01/26/2010 17:00	193.20	10.75
01/26/2010 18:00	224.50	7.06
01/26/2010 19:00	199.40	7.46
01/26/2010 20:00	174.10	5.21
01/26/2010 21:00	164.70	3.49
01/26/2010 22:00	0.86	2.42
01/26/2010 23:00	251.50	1.18
01/27/2010 00:00	222.60	3.98
01/27/2010 01:00	80.90	1.43
01/27/2010 02:00	42.71	2.79
01/27/2010 03:00	56.21	2.13
01/27/2010 04:00	29.28	2.13
01/27/2010 05:00	30.24	1.49
01/27/2010 06:00	353.00	2.90
01/27/2010 07:00	329.30	2.61
01/27/2010 08:00	11.26	3.87
01/27/2010 09:00	358.80	4.74

01/27/2010 10:00	13.62	5.50
01/27/2010 11:00	23.72	5.79
01/27/2010 12:00	19.01	7.30
01/27/2010 13:00	12.66	7.95
01/27/2010 14:00	12.31	7.23
01/27/2010 15:00	3.99	7.45
01/27/2010 16:00	15.98	5.32
01/27/2010 17:00	350.50	4.50
01/27/2010 18:00	346.00	3.61
01/27/2010 19:00	349.30	3.76
01/27/2010 20:00	291.70	4.20
01/27/2010 21:00	307.10	3.40
01/27/2010 22:00	312.00	2.15
01/27/2010 23:00	27.14	2.32
01/28/2010 00:00	333.20	3.38
01/28/2010 01:00	265.10	2.88
01/28/2010 02:00	283.90	4.59
01/28/2010 03:00	271.90	2.89
01/28/2010 04:00	322.40	2.06
01/28/2010 05:00	237.40	2.78
01/28/2010 06:00	85.60	0.69
01/28/2010 07:00	315.90	1.76
01/28/2010 08:00	349.70	4.22
01/28/2010 09:00	339.60	5.57
01/28/2010 10:00	8.22	6.06
01/28/2010 11:00	13.93	7.74
01/28/2010 12:00	9.71	7.50
01/28/2010 13:00	36.88	6.04
01/28/2010 14:00	28.32	5.10
01/28/2010 15:00	21.97	3.87
01/28/2010 16:00	354.70	5.84
01/28/2010 17:00	7.42	4.10
01/28/2010 18:00	11.42	3.90
01/28/2010 19:00	1.60	5.67
01/28/2010 20:00	25.05	2.38
01/28/2010 21:00	324.30	3.64
01/28/2010 22:00	17.43	1.27
01/28/2010 23:00	343.60	4.53
01/29/2010 00:00	9.14	4.73
01/29/2010 01:00	11.48	4.78
01/29/2010 02:00	340.90	3.97
01/29/2010 03:00	357.70	6.34
01/29/2010 04:00	358.30	4.36
01/29/2010 05:00	352.70	4.73
01/29/2010 06:00	14.23	5.10
01/29/2010 07:00	14.40	4.33

01/29/2010 08:00	359.10	3.83
01/29/2010 09:00	13.09	4.12
01/29/2010 10:00	8.65	3.86
01/29/2010 11:00	9.22	4.85
01/29/2010 12:00	5.93	5.67
01/29/2010 13:00	7.15	6.06
01/29/2010 14:00	359.40	7.11
01/29/2010 15:00	7.28	6.52
01/29/2010 16:00	17.29	7.62
01/29/2010 17:00	19.05	6.10
01/29/2010 18:00	349.90	4.71
01/29/2010 19:00	4.74	6.69
01/29/2010 20:00	342.00	4.22
01/29/2010 21:00	18.63	4.12
01/29/2010 22:00	24.37	3.40
01/29/2010 23:00	34.16	6.81
01/30/2010 00:00	17.51	7.61
01/30/2010 01:00	19.41	5.07
01/30/2010 02:00	40.08	9.80
01/30/2010 03:00	26.94	7.07
01/30/2010 04:00	21.79	3.70
01/30/2010 05:00	359.70	4.74
01/30/2010 06:00	30.26	5.88
01/30/2010 07:00	353.70	2.00
01/30/2010 08:00	31.05	7.41
01/30/2010 09:00	29.83	11.52
01/30/2010 10:00	28.23	9.56
01/30/2010 11:00	15.57	10.73
01/30/2010 12:00	25.71	13.53
01/30/2010 13:00	17.28	9.16
01/30/2010 14:00	15.70	10.87
01/30/2010 15:00	15.42	8.87
01/30/2010 16:00	37.54	5.68
01/30/2010 17:00	357.40	5.70
01/30/2010 18:00	2.08	3.48
01/30/2010 19:00	345.10	4.84
01/30/2010 20:00	349.70	4.68
01/30/2010 21:00	297.10	3.75
01/30/2010 22:00	305.80	4.17
01/30/2010 23:00	327.50	4.55
01/31/2010 00:00	16.65	4.79
01/31/2010 01:00	5.48	3.84
01/31/2010 02:00	24.33	4.31
01/31/2010 03:00	22.70	3.77
01/31/2010 04:00	29.82	2.73
01/31/2010 05:00	26.95	3.00

01/31/2010 06:00	154.00	1.85
01/31/2010 07:00	201.30	9.53
01/31/2010 08:00	220.90	9.70
01/31/2010 09:00	223.80	10.70
01/31/2010 10:00	235.10	10.18
01/31/2010 11:00	235.30	7.70
01/31/2010 12:00	234.90	10.93
01/31/2010 13:00	230.70	8.38
01/31/2010 14:00	233.30	6.75
01/31/2010 15:00	222.50	8.33
01/31/2010 16:00	225.80	8.39
01/31/2010 17:00	252.20	10.71
01/31/2010 18:00	254.80	11.04
01/31/2010 19:00	271.80	8.20
01/31/2010 20:00	245.30	7.23
01/31/2010 21:00	243.00	8.96
01/31/2010 22:00	221.50	9.60
01/31/2010 23:00	211.00	8.79

APPENDIX D

CONTAM-W CALCULATION PROCEDURES
(from the Program Help file)

BASIC EQUATIONS

The air flow rate from zone j to zone i, $F_{j,i}$[kg/s], is some function of the pressure drop along the flow path, P_j - P_i:

$$F_{ji} = f\left(P_j - P_i\right) \tag{1}$$

The mass of air, m_i [kg], in zone i is given by the ideal gas law

$$m_i = \rho_i V_i = \frac{P_i V_i}{RT_i} \tag{2}$$

where

V_i = zone volume [m^3],
P_i= zone pressure [Pa],
T_i= zone temperature [K], and
R= 287.055 [J/kg·K] (gas constant for air).

For a transient solution the principle of conservation of mass states that

$$\frac{\partial m_i}{\partial t} = \rho_i \frac{\partial V_i}{\partial t} + V_i \frac{\partial m_i}{\partial t} = \sum_j F_{ji} + F_i \tag{3}$$

$$\frac{\partial m_i}{\partial t} \approx \frac{1}{\Delta t}\left[\left(\frac{P_i V_i}{RT_i}\right)_t - \left(m_i\right)_{t-\Delta t}\right] \tag{4}$$

where

m_i= mass of air in zone i,

$F_{j,i}$= airflow rate [kg/s] between zones j and zone i: positive values indicate flows from j to i and negative values indicate flows from i to j, and

F_i>= non-flow processes that could add or remove significant quantities of air from the zone.

CONTAM 1.0 did not provide for such non-flow processes and flows were evaluated by assuming quasi-steady conditions leading to the following equation

$$\sum_j F_{ji} = 0 \qquad (5)$$

CONTAM can now provide for such non-flow processes by allowing the density to vary during time steps when performing transient simulations.

You can activate this option with the *Vary Density During Time Step* setting under the Airflow Numerics Simulation Parameters. If this parameter is set then, equation 3 is implemented when performing airflow calculations; otherwise equation 5 is used.

SOLVING THE EQUATIONS

The steady-state airflow analysis for multiple zones requires the simultaneous solution of equation (5) for all zones. Since the function in equation (1) may be, and usually is, nonlinear, a method is needed for the solution of simultaneous nonlinear algebraic equations. The Newton-Raphson (N-R) method [Conte and de Boor 1972 p. 86] solves the nonlinear problem by an iteration of the solutions of linear equations. In the N-R method a new estimate of the vector of all zone pressures, $\{\mathbf{P}\}^*$, is computed from the current estimate of pressures, $\{\mathbf{P}\}$, by

$$\{P\}^* = \{P\} - \{C\} \tag{6}$$

where the correction vector, $\{\mathbf{C}\}$, is computed by the matrix relationship

$$[J]\{C\} = \{B\} \tag{7}$$

where $\{\mathbf{B}\}$ is a column vector with each element given by

$$B_i = \sum_j F_{ji} \tag{8}$$

and $[\mathbf{J}]$ is the square (i.e. N by N for a network of N zones) Jacobian matrix whose elements are given by

$$J_{ij} = \sum_i \frac{\partial F_{ji}}{\partial P_j} \tag{9}$$

In equations (8) and (9) $F_{j,i}$ and $\partial F_{j,i}/\partial P_j$ are evaluated using the current estimate of pressure $\{\mathbf{P}\}$. The ContamX program contains subroutines for each airflow element which return the mass flow rates and the partial derivative values for a given pressure difference input.

Equation (7) represents a set of linear equations which must be set up and solved for each iteration until a convergent solution of the set of zone pressures is achieved. In its full form $[\mathbf{J}]$ requires computer memory for N^2 values, and a standard Gauss elimination solution has execution time proportional to N^3. Sparse matrix methods can be used to reduce both the storage and execution time requirements. A skyline solution process following the method presented in [Dhatt 1984] was chosen. This method can be used to solve equations with symmetric or asymmetric matrices. It stores no zero values above the highest nonzero element in the columns above the diagonal and no zero values to the left of the first nonzero value in each row below the diagonal. In this case the Jacobian matrix is symmetric. CONTAM provides two solution methods for the linear equations:

Skyline (also called profile method) and Pre-conditioned Conjugate Gradient (PCG). PCG may be useful for problems with many zones and junctions.

Analysis of the element models will show that

$$\left|J_{ii}\right| = \sum_{j \neq i} \left|J_{ij}\right| \tag{10}$$

This condition allows a solution without pivoting, although scaling may be useful. Note that the degree of sparsity of the Jacobian matrix after factoring is dependent on the ordering of the zones. Ordering can be improved by various algorithms or rules-of-thumb. In AIRNET it was easy to define an airflow network which had no unique solution. The ContamW user interface insures the correct interconnection of the airflow elements in the network.

CONTAM allows zones with either known or unknown pressures. The constant pressure zones are included in the system of equations and equation (7) is processed so as to not change those zone pressures. This gives flexibility in defining the airflow network while maintaining the symmetric set of equations. A sufficient condition for the Jacobian to be nonsingular [Axley 1987] is that all of the unknown pressure zones be linked by pressure dependent flow paths to (a) constant pressure zone(s). In CONTAM the ambient (or outdoor) air is treated as a constant pressure zone. The ambient zone pressure is assumed to be zero for the flow calculation causing the computed zone pressures to be values relative to the true ambient pressure and helping to maintain numerical significance in calculating ΔP.

Conservation of mass at each zone provides the convergence criterion for the N-R iterations. That is, when equation (4) is satisfied for all zones for the current system pressure estimate, the solution has converged. Sufficient accuracy is attained by testing for relative convergence at each zone:

$$\frac{\left|\sum_j F_{ji}\right|}{\sum_j \left|F_{ji}\right|} \langle \varepsilon \tag{11}$$

with a test ($\Sigma|F_{j,i}| < \varepsilon 1$, the absolute convergence factor) to prevent division by zero. The magnitude of ε can be established by considering the use of the calculated airflows, such as in an energy balance. In any case, round-off errors may prevent perfect convergence ($\varepsilon = 0$).

Numerical tests of the N-R method solution indicated occasional instances of very slow convergence as the iterations almost oscillate between two different sets of values. In AIRNET, this was handled by a Steffensen acceleration process. More recent tests by the author and by Wray [Wray 1993] indicate that the use of a simpler constant under-relaxation coefficient produces a faster, reliable convergence acceleration process. Equation (6) for the iteration process becomes

$$\{P\}^* = \{P\} - \omega\{C\} \tag{12}$$

where ω is the relaxation coefficient. A relaxation coefficient of 0.75 has been found to be usable for a broad range of airflow networks. This value is not a true optimum but appears to work quite well without the computational cost of finding the theoretically optimum value.

When convergence is progressing rapidly, under-relaxation ($\omega < 1$) slows convergence compared to no relaxation. To prevent this a global convergence value is computed:

$$\gamma = \frac{\sum_i \left| \sum_j F_{ji} \right|}{\sum_i \sum_j \left| F_{ji} \right|} \tag{13}$$

When $\gamma^* < \alpha\gamma$, ω is set to 1. Currently CONTAM uses $\alpha = 30\%$. This often reduces the number of iterations. This is simple under-relaxation. CONTAM also may alternatively use a simple trust region method implemented by David M. Lorenzetti based on [Dennis and Schnabel 1996].

Newton's method requires an initial set of values for the zone pressures. These may be obtained by including in each airflow element model a linear approximation relating the flow to the pressure drop:

$$F_{ji} = c_{ji} + b_{ji}\left(P_j - P_i\right) \tag{14}$$

Conservation of mass at each zone leads to a set of linear equations of the form

$$[A]\{P\} = \{B\} \tag{15}$$

Matrix [**A**] in equation (15) has the same sparsity pattern as [**J**] in equation (7) allowing use of the same sparse matrix solution process for both equations. This initialization handles stack effects very well and tends to establish the proper directions for the flows. The linear approximation is conveniently provided by the laminar regime of the element models used by CONTAM. When solving a set of similar problems, as when approximating a transient solution by successive steady-state solutions, it tends to be preferable to use the previous solution for the zone pressures as the initial values for the new problem.

CUBIC SPLINE MODELS

Cubic spline models enable you to create airflow elements based on a curve fit to a user-defined set of data points. The cubic spline fit used to generate the curve guarantees a first-order differentiable relationship between flow and pressure as required by the CONTAM solver. During simulation, the sign of the pressure difference will be based on the *Positive Flow Direction* defined for the flow paths with which the spline elements are associated. For example, a drop in pressure in the direction of positive flow (i.e. Pressure in from zone – Pressure in to zone > 0) will utilize a positive pressure from the spline data.

There are some basic requirements for each of these elements. They require a minimum of four data points, so a curve will not be displayed until the minimum number of points is entered. All models require that the slope be greater than zero for all segments of the curve fit. If there is an error in the curve fit when you click the OK button, an error message will be displayed indicating the offending segments of the curve and a reason for the error. Segments are numbered from zero to the number of data points minus one. For example – "`seg 0: y′ <= 0`" will be displayed if the segment between the first two data points has a slope less than or equal to zero.

Name: Enter the name you want to use to identify the airflow element.

Description: Field for entering a more detailed description of the specific airflow element.

Curve Data: Create and edit the list of data points to define the curve for the airflow element. The type of cubic spline element you are editing determines the independent and dependent variables for the curve. The labels of the list, data entry fields and associated units will change accordingly, as will the axes of the plot. Use the data entry fields along with the "Add" button to create new and edit existing data points. Use the "Delete" button to remove the currently selected data point from the list.

Icon: Choose either the small or large opening icon as appropriate for the specific airflow element. The icon has no effect on the simulations.

Cubic Spline: F vs. P

Mass flow as a function of Pressure drop across the element.

Cubic Spline: Q vs. P

Volume flow as a function of Pressure drop across the element.

Cubic Spline: P vs. F

Pressure drop as a function of Mass flow through the element.

Cubic Spline: P vs. Q

Pressure drop as a function of Volume flow through the element.

Powerlaw Flow Elements

Most infiltration models are based on the following empirical (powerlaw) relationship between the flow and the pressure difference across a crack or opening in the building envelope:

$$Q = C(\Delta P)^n \tag{18}$$

The volumetric flow rate, Q [m^3/s], is a simple function of the pressure drop, ΔP [Pa], across the opening. A common variation of the powerlaw equation is:

$$F = C(\Delta P)^n \tag{19}$$

where the mass flow rate, F [kg/s], is a simple function of the pressure drop. A third variation is related to the orifice equation:

$$Q = C_d A \sqrt{\frac{2\Delta P}{\rho}} \tag{20}$$

where

C_d= discharge coefficient, and
A= orifice opening area.

Theoretically, the value of the flow exponent should lie between 0.5 and 1.0. Large openings are characterized by values very close to 0.5, while values near 0.65 have been found for small crack-like openings.

The primary advantage of equations (18-20) for describing airflow components is the simple calculation of the partial derivatives for the Newton's method solution of the simultaneous equations:

$$\frac{\partial F_{ji}}{\partial P_j} = \frac{nF_{ji}}{\Delta P} \quad \text{and} \quad \frac{\partial F_{ji}}{\partial P_i} = \frac{-nF_{ji}}{\Delta P} \tag{21}$$

The sign in equations (21) will agree with the sign of F. However, there is also a problem with equations (21): the derivatives become unbounded as the pressure drop (and the flow) go to zero. A simple way to avoid this problem is suggested by what physically happens at low flow rates: the physical character of the flow (and the form of the equation) changes. It goes from turbulent to laminar. Equations (18-20) can be replaced by

$$F = \frac{C_x \rho \Delta P}{\mu} \tag{22}$$

where

C_k= laminar flow coefficient, and
μ= viscosity.

The partial derivatives are simple constants:

$$\frac{\partial F_{ji}}{\partial P_j} = \frac{C_x P}{\mu} \quad \text{and} \quad \frac{\partial F_{ji}}{\partial P_i} = \frac{-C_x \rho}{\mu} \tag{23}$$

The origin of this laminar relationship is shown by the duct equations in the next section. This technique has been independently discovered and used by several researchers [Axley 1987] and [Isaacs 1980]. Although there is physical reason for using equation (22) at low pressure drops, its purpose here is to assure convergence of the equations when ΔP approaches zero for one of the many flow paths in a complex network, instead of accurately representing airflows which are too small to be of interest. Because the linear flow expression is not used as a true flow model but as a mathematical artifice, it is not necessary to adjust its flow coefficient. Given the uncertainty in estimating the temperature of the air as it flows through an opening, especially a crack, this additional detail is of debatable usefulness.

The CONTAM functions for powerlaw elements calculate flows using both the laminar and the turbulent models and select the method giving the smaller magnitude flow. There is a discontinuity in the derivative of the $F(\Delta P)$ curve where the two equations intersect. This discontinuity is a violation of one of the sufficient conditions for convergence of Newton's method [Conte and de Boor 1972, p. 86]. However, numerical tests conducted by the author for flows at that point using a small airflow network have shown no convergence problem.

Temperature Dependence

It is useful to think of the coefficient C as a simple constant, C_α, evaluated at a particular set of conditions (μ_0, ρ_0 and $\nu_0=\mu_0/\rho_0$) multiplied by a correction factor to account for actual air properties. Equations (18-20) are converted to a common form and summarized below with their appropriate temperature correction factors.

$\Delta P \rangle 0$	$\Delta P \langle 0$	Correction Factor
$F_{ji} = K_a C_a \rho_j (\Delta P)^x$	$F_{ji} = -K_a C_a \rho_j (-\Delta P)^x$	$K_a = (\rho_o / \rho)^x (\nu_o / \nu)^{2x-1}$
$F_{ji} = K_b C_b \sqrt{\rho_j} (\Delta P)^x$	$F_{ji} = -K_b C_b \sqrt{\rho_j} (-\Delta P)^x$	$K_b = (\rho_o / \rho)^{x-1/2} (\nu_o / \nu)^{2x-1}$ (24)

$$F_{ji} = K_c C_c (\Delta P)^n \qquad F_{ji} = -K_c C_c (-\Delta P)^n \qquad K_c = (\rho_o / \rho)^{n-1} (\nu_o / \nu)^{2n-1}$$

CONTAM uses the following formulae for computing ρ and ν:

$\rho = P / (287.055\ T)$

$\mu = 3.7143\times10^{-6} + 4.9286\times10^{-8}T$

$\nu = \mu / \rho$

Using reference conditions of standard atmospheric pressure and 20°C gives ρ_o = 1.2041 kg/m^3 and ν_o = 1.5083×10^{-5} m^2/s.

Fitting Powerlaw Coefficients

Experimental data can be used to determine the coefficients in the orifice form of the powerlaw equation:

$$F = \pm C_b \sqrt{\rho_o} (\pm \Delta P)^n \qquad (K_b = 1) \tag{25}$$

If n is known or can be assumed, C_b, in equation (24), can be computed from the inverse of equation (25)

$$C_b = \frac{F}{\sqrt{\rho_o} (\Delta P)^n} \tag{26}$$

When two points (F_1, ΔP_1) and (F_2, ΔP_2), are known, n can be computed from:

$$n = \frac{\ln(F_1) - \ln(F_2)}{\ln(\Delta P_1) - \ln(\Delta P_2)} \tag{27}$$

with C_b then computed from equation (26).

LEAKAGE AREAS

The powerlaw model can be used with the component leakage area formulation which has been used to characterize openings for infiltration calculations [ASHRAE 2001, p. 25.18]. The leakage area is based on a series of pressurization tests where the airflow rate is measured at a series of pressure differences ranging from about 10 Pa to 75 Pa. The effective leakage area is based on a rearrangement of equation (20)

$$L = \frac{Q_r \sqrt{\rho / 2\Delta P_r}}{C_d} \tag{28}$$

where

L= equivalent or effective leakage area [m^2],

ΔP_r= reference pressure difference [Pa],

Q_r= predicted airflow rate at ΔP_r (from curve fit to pressurization test data) [m^3/s], and

C_d= discharge coefficient.

There are two common sets of reference conditions:

C_d = 1.0 and ΔP_r = 4 Pa

or

C_d = 0.6 and ΔP_r = 10 Pa.

A leakage area can be converted to the flow coefficient by

$$C_b = L C_d \sqrt{2} \left(\Delta P_r\right)^{\frac{1}{2} - n} \tag{29}$$

This equation requires a value for n. If it is not reported with the test results, a value between 0.6 and 0.7 is reasonable.

Stairwells

A stairwell will normally be modeled as a vertical series of zones connected by low resistance openings through the floors. The CONTAM model for airflow in stairwells is based on a fit to experimental data [Achakji and Tamura 1988]. They expressed the airflow resistance per floor as an effective area A_e in the orifice equation (20) with a 0.6 discharge coefficient. The effective area is expressed in terms of the area of the shaft A_S, the distance between floors h, the density of people on the stairs d, and whether the treads are open or closed. A large number of people on the stairs, as in an evacuation scenario, influences the flow resistance. The experiment used densities of 0, 1, and 2 persons/m^2. For open treads the effective area is approximately

$$A_e = A_s \left(0.089h\right)\left(1.0 - 0.14\sqrt{d}\right) \tag{30}$$

and for closed treads

$$A_e = A_s \left(0.0834h\right)\left(1.0 - 0.24\sqrt{d}\right) \tag{31}$$

The coefficients for the powerlaw equation are

$$n = 0.5 \quad \text{and} \quad C_b = 0.6 \cdot \sqrt{2} \cdot A_e \tag{32}$$

Cracks

A relationship for flow through cracks that can be converted directly into a powerlaw airflow element is presented in [Clarke 1985, p. 204] as:

$$Q = ka(\Delta P)^n \tag{33}$$

where

$$n = 0.5 + 0.5\exp(-W/2) \tag{34}$$

and

$$k = 0.0097 \cdot (0.0092)^n \tag{35}$$

with

W = crack width (mm), and

a = crack length (m).

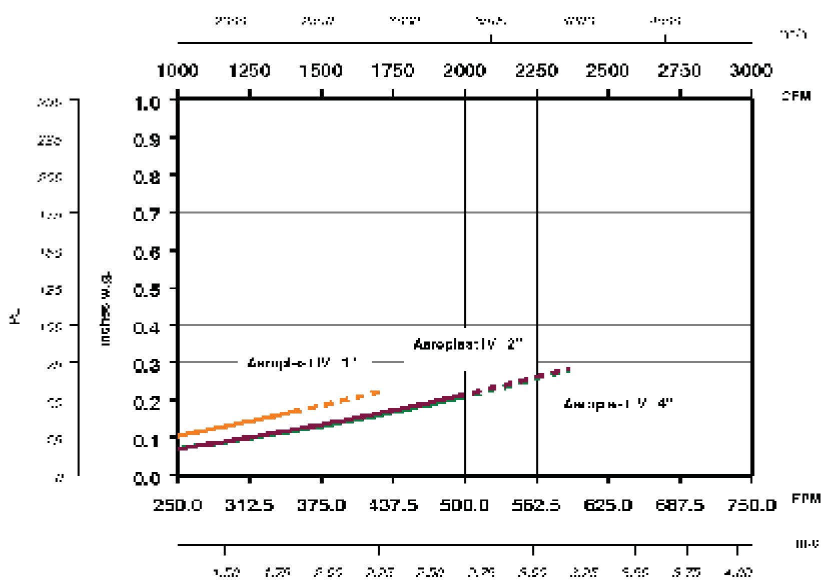
Therefore, the coefficients in the powerlaw equation (19) are given by n in equation (34) and

$$C_b = \sqrt{\rho_o}\, a 0.0097 (0.0092)^n \tag{36}$$

Aeropleat® IV

Initial Resistance Versus Airflow

Final resistance (maximum recommended) is 1.0" w.g. (250 Pa.)
System design may dictate a lower change out point.
Maximum continuous operating temperature 180° F (82° C).
Consult factory before operating in dotted line region.



Camfil Farr	Technical Data
Aeropleat® IV	1012-IRVA - 0409
Camfil Farr - clean air solutions	

APPENDIX E

FAN PERFORMANCE CURVES

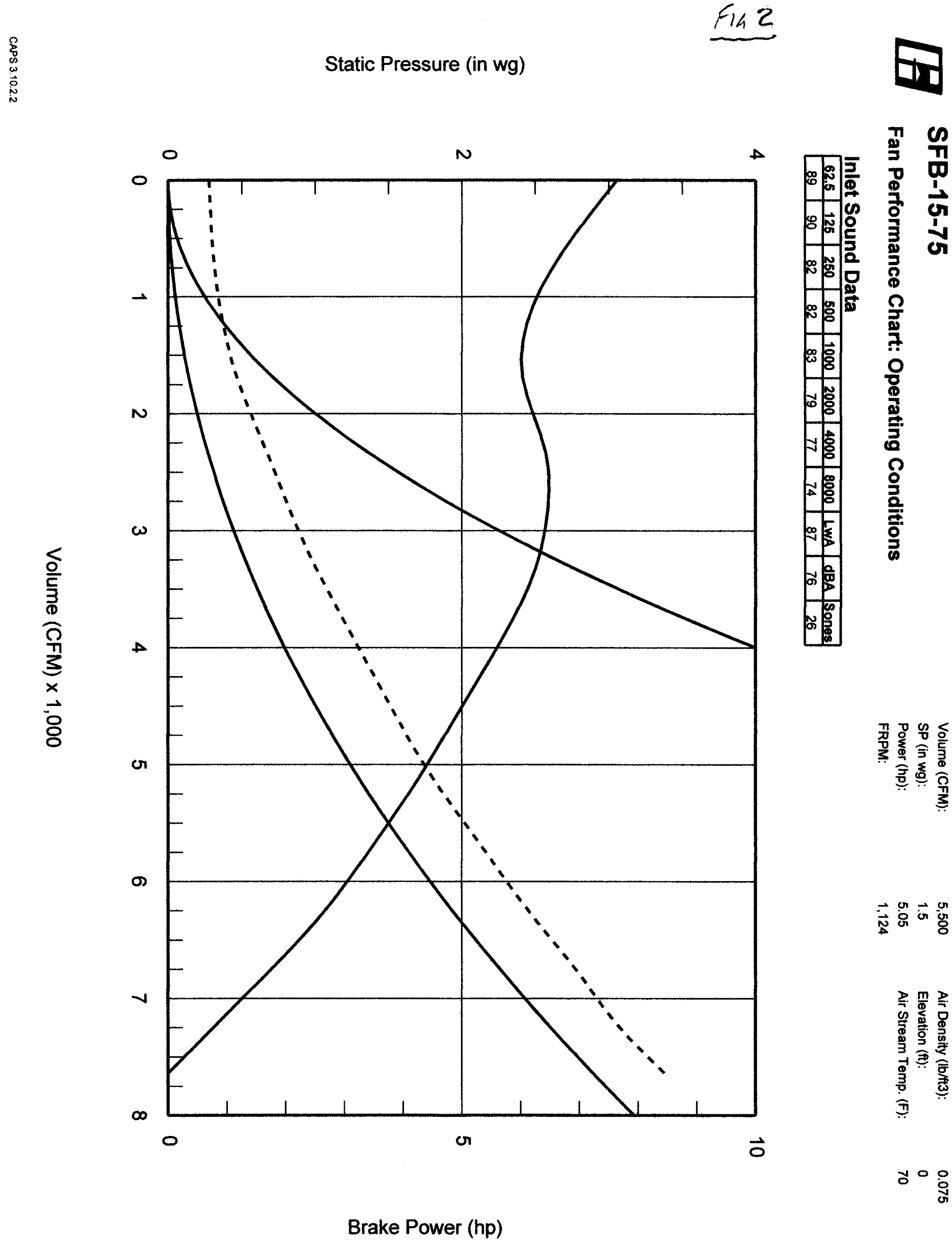


Figure 2 – Fan Performance Curve

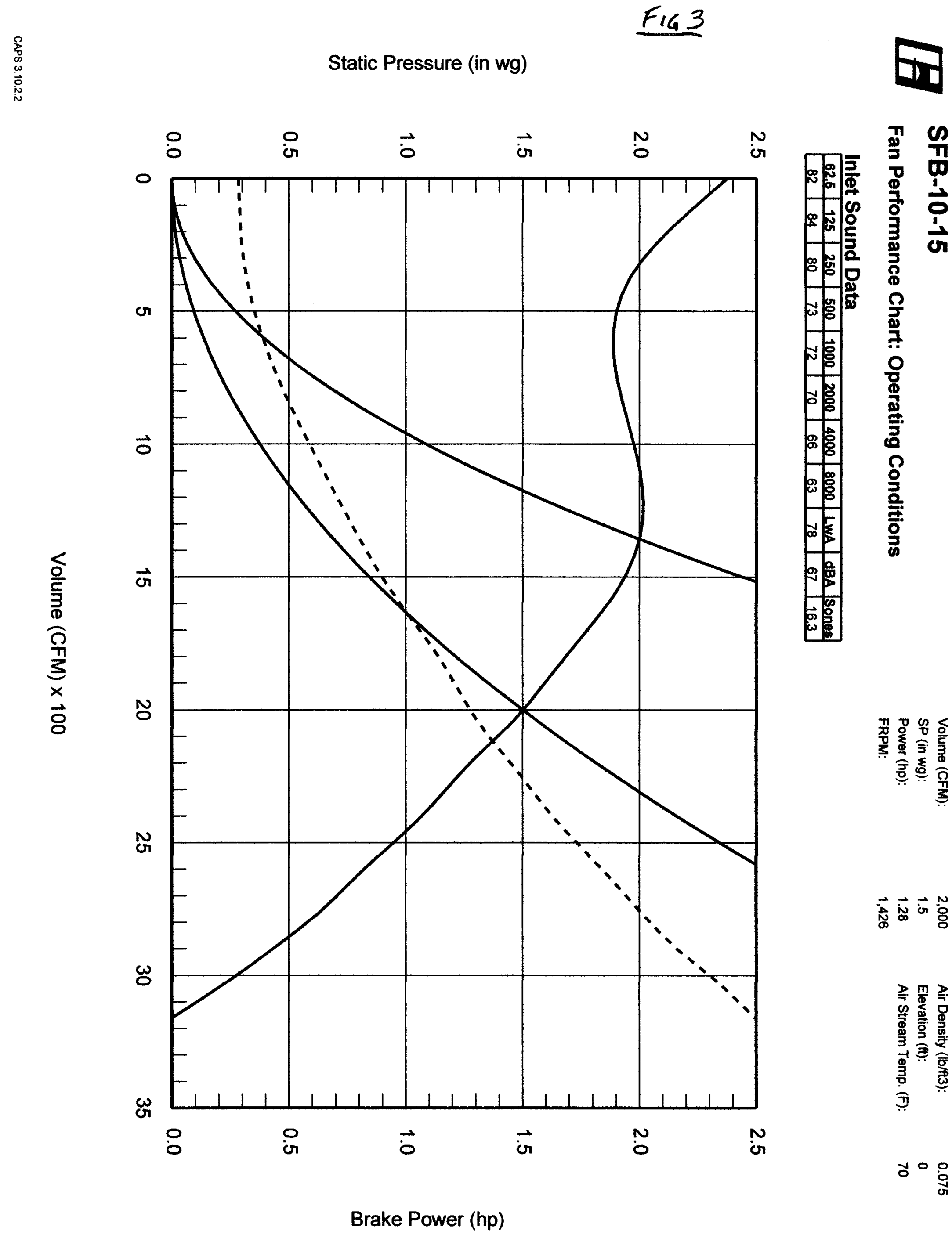


Figure 3 – Fan Performance Curve

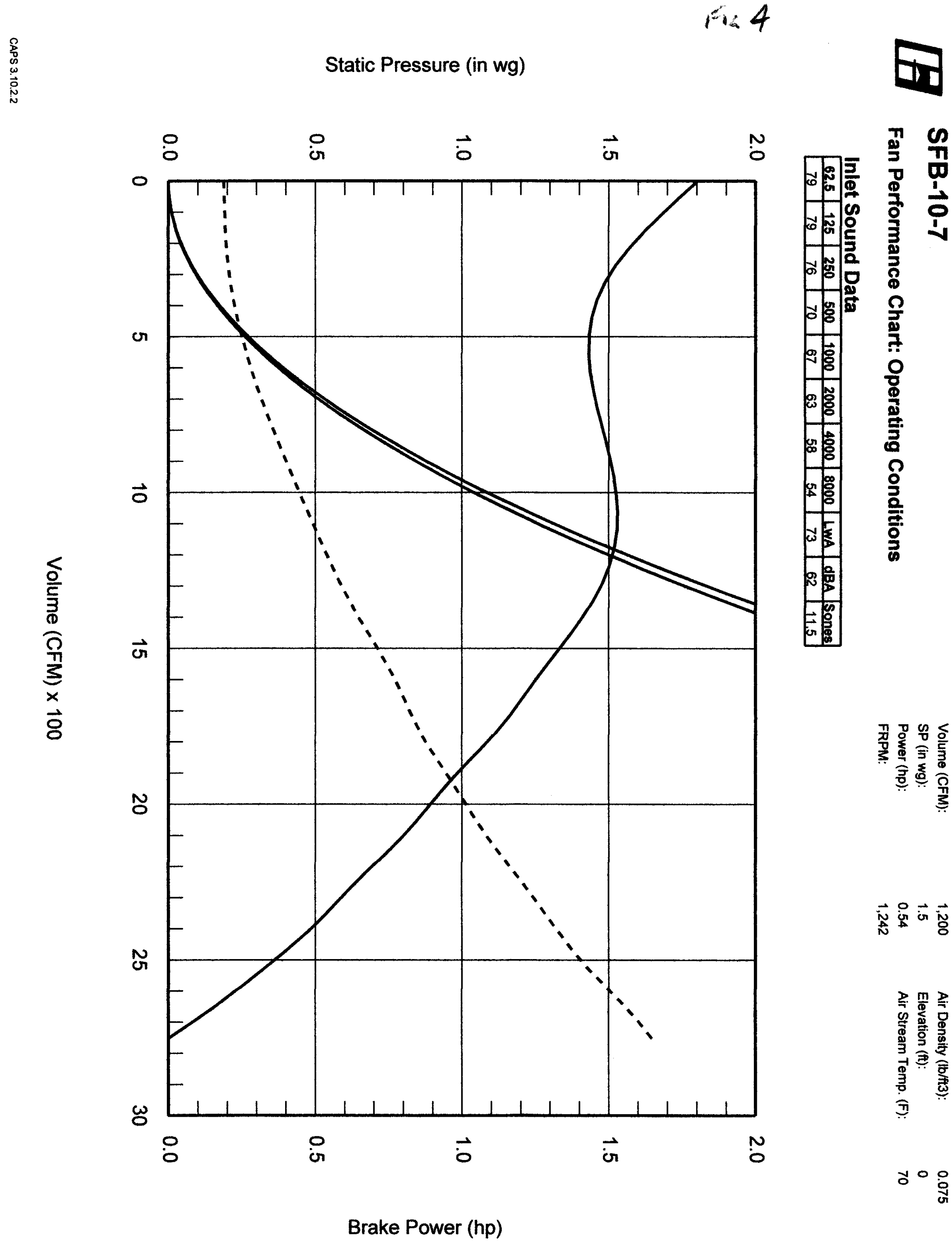


Figure 4 – Fan Performance Curve

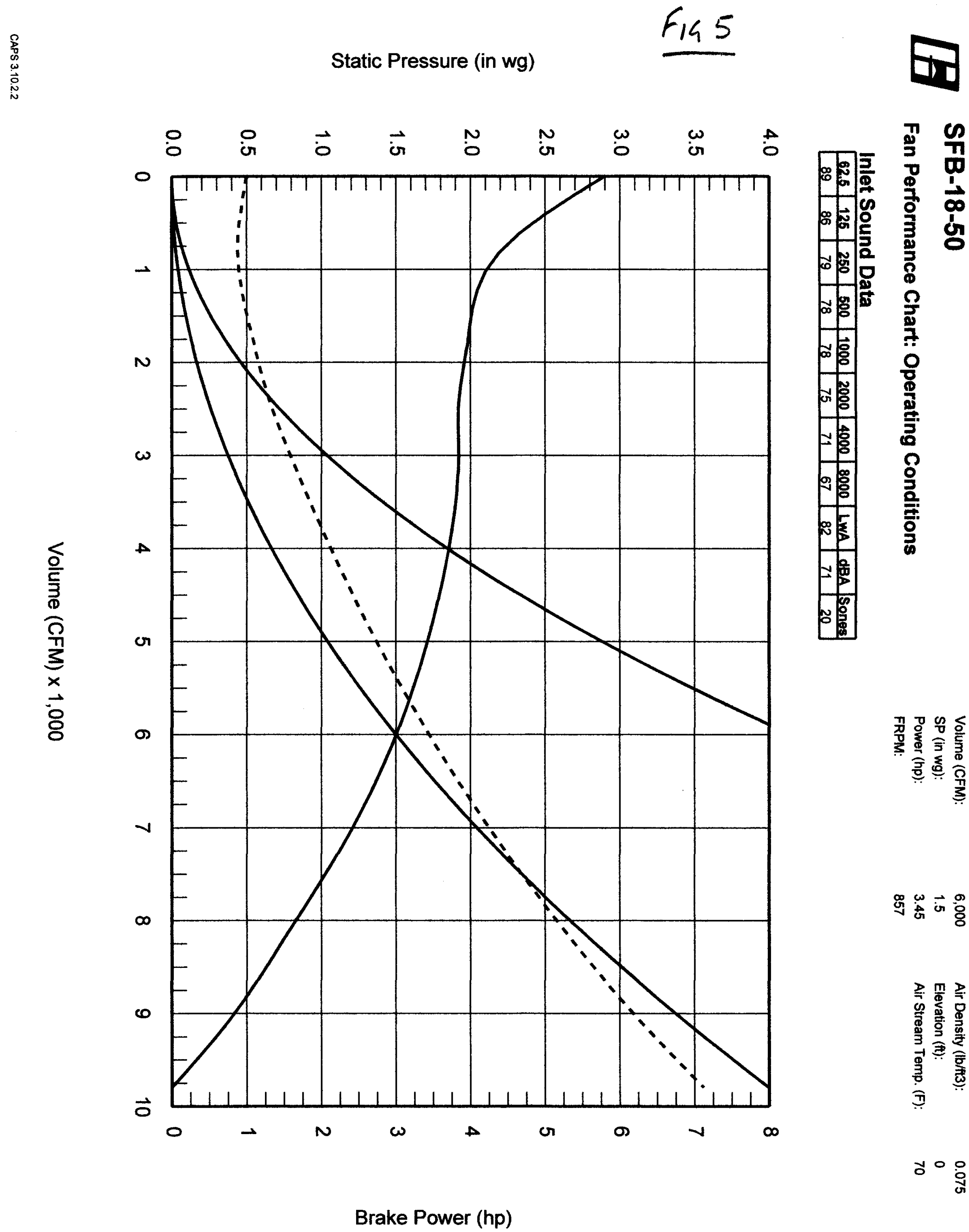


Figure 5 – Fan Performance Curve

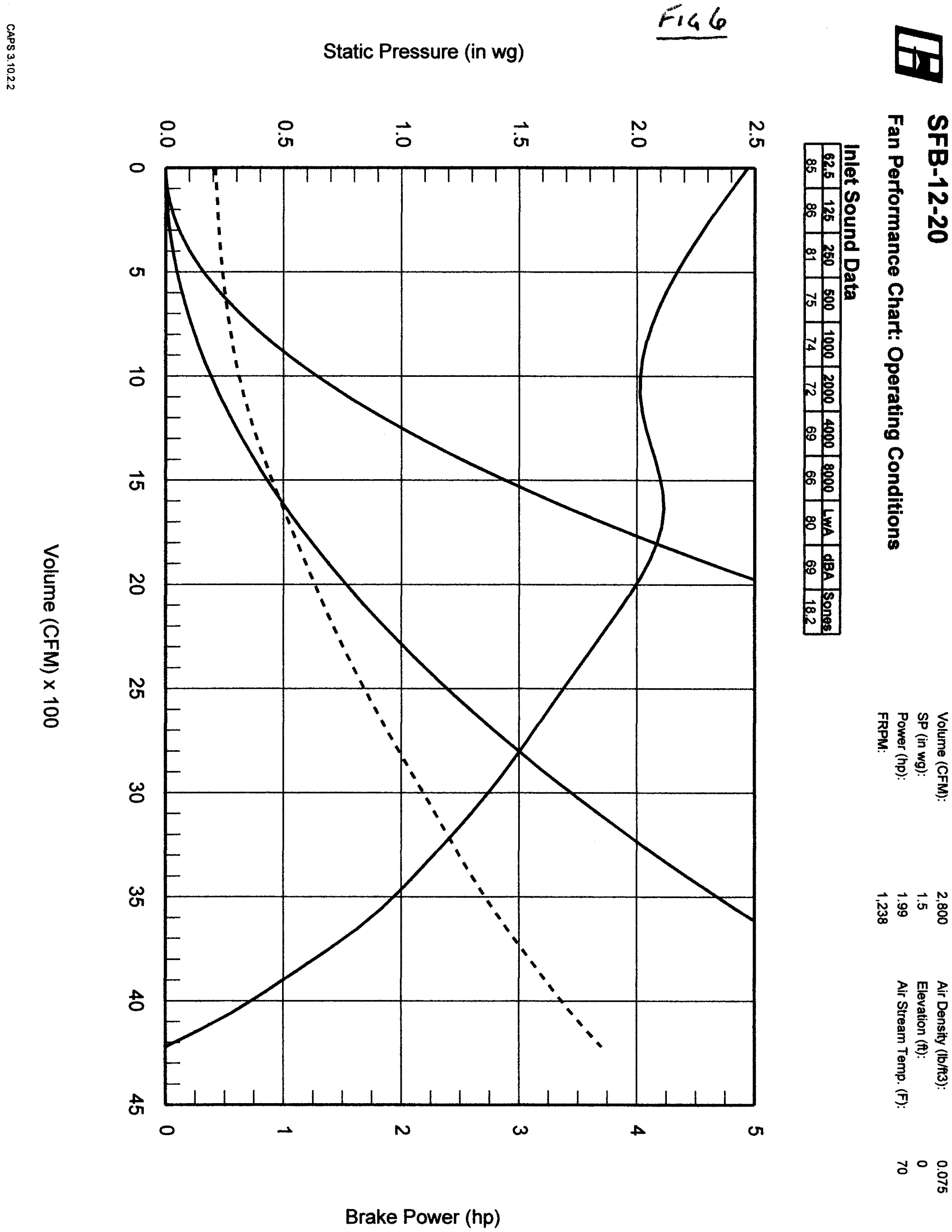


Figure 6 – Fan Performance Curve

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